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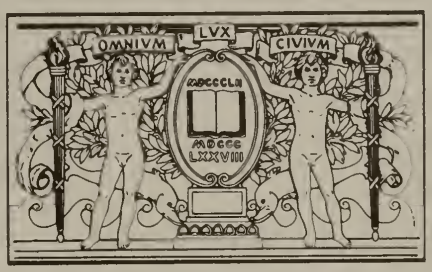

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REPORT OF THE
BOSTON CONSUMERS' COUNCIL
TO THE
HONORABLE KEVIN H. WHITE, MAYOR
ON THE DEVELOPMENT OF
A CABLE TELEVISION SYSTEM

NOVEMBER 1973

BOSTON CONSUMERS' COUNCIL
CITY HALL, BOSTON, MASS. 02201

KEVIN H. WHITE
Mayor
MAUREEN F. SCHAFFNER
Chairman
RICHARD A. BORTEN
Executive Director

REPORT OF THE BOSTON CONSUMERS' COUNCIL TO THE HONORABLE KEVIN H. WHITE, MAYOR ON THE DEVELOPMENT OF A CABLE TELEVISION SYSTEM

NOVEMBER . 1973

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RUTH STRAUSS, PUBLIC MEMBER
MICHAEL TARALLO, LABOR REPRESENTATIVE

RICHARD A. BORTEN, EXECUTIVE DIRECTOR

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MR. THEODORE WELLS OF THE HARVARD BUSINESS SCHOOL,

CHRISTOPHER B. FAGER, ESQ.,

MR. CARMINE BUONO, MR. GERALD BUSH, MS. LOUISE ELVING, THOMAS HARGADON, ESQ., PETER KOFF, ESQ., MS. PAT MROWKA, DR. JOHN MYERS, AND MR. VINCENT O'DONNELL OF THE CITY OF BOSTON.

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GLOSSARY

Report of the Boston Consumers' Council to the Honorable Kevin H. White, Mayor on the Development of a Cable Television System

Foreword:

For the past eighteen months the Boston Consumers' Council has been engaged in a comprehensive study of the issues surrounding the development of a cable television system for the City of Boston.

The Consumers' Council has found cable to be a highly complex subject, and fully realizes that CATV may someday develop into a consumer service comparable in scope to the three major public utilities (gas, electric, and telephone).

But cable television has yet to provide solutions to the communications problems of the nation's cities, or to fulfill its promise of creating a new communications era. The Consumers' Council has, therefore, sought to evaluate the technological and economic constraints affecting cable, along with the legal questions, ownership alternatives and regulatory problems of CATV.

This presentation is designed to give an overview of the issues of cable T.V., its benefits and liabilities. It reflects the shared

thinking of the members of the Consumers' Council after consulting with experts at the Massachusetts Institute of Technology; interviewing potential cable operators, official of the Federal Communications Commission and the Massachuset Community Antenna Television Commission; and conducting a series of public hearings which sought public opinion on the issue of cable television development in Boston.

INTRODUCTION

Conventional television signals travel over-the-air from a TV station's transmitter to a home set. The distance between the transmitter and the home set, or obstacles lying in the path of the TV signal (such as mountains or tall buildings) can affect the quality of television reception; and because the television-radio airways are already crowded with over-the-air TV, radio, and official communications signals, the number of channels that can be carried on conventional television are limited.

Cable television, or CATV, can eliminate the problems of bad reception and channel scarcity. Using a large antenna located on a high point, cable pulls conventional signals out of the air, electronically improves them, and sends them through a wire called a coaxial cable to the home set. The cable is strung on utility poles or laid in underground ducts and is connected directly to a subscriber's set for an installation charge (usually $15 to $20) and a monthly fee (usually $5 to $8).

Cable systems developed first in isolated areas that could not pick up over-the-air TV signals. In these communities a cable operator could realize a good profit on a modest investment simply by offering a few channels. But in recent years CATV has begun to develop in major cities, where 20 or more channels are often offered, including some to be used by the local government, educational system, and community groups.

Advocates point out that CATV is capable of offering hundreds of unique and valuable services to urban centers. However, it should be noted that few such capabilities have actually been implemented on even the most modern cable systems, and that other communications systems may be able to provide the same services at lower costs.

Cable is often seen as the potential major medium for the delivery of library and mail services, home shopping and banking, and educational programming for people who are confined to their homes. Two-way cable, many believe, will bring about a new era in education, polling, and community decision-making, providing the localized access to channel usage that over-the-air TV has been unable provide.

Because cable systems have a relative abundance of channels, they can offer programming for specific neighborhoods and groups, rather than having to seek mass audiences. Some of the exciting notions that have interested cities in cable television are:

- Special programming services for the deaf, senior citizens, non-English speaking groups, teachers, doctors, etc.
- Home instruction for children and others who are confined to their homes, working people who want an opportunity to take college courses, people in need of vocational training
- Commercial uses including computer communications (thereby freeing telephone lines), banking services, meter reading, marketing research, transportation control, credit information checks, security systems, employee training, etc.
- Community programming including community meetings, neighborhood news shows, ethnic programming, etc.
- Official communications such as fire and police communication street surveillance, tele-medicine, public transportation control, etc.

While these ideas reflect the potential of CATV, only about 15% of the nation's more than 2,500 cable systems provide any liv

or pre-recorded local programming beyond simple automated weather and stock market reports. Most of this programming consists of town meetings, public hearings, and school athletic events.

A few major systems, like the TelePrompTer system in New York, show otherwise blacked-out professional basketball and hockey matches, and such special programming as the National Black Political Convention, the Attica prison riot hearings, and a discussion on transsexual operations.

Commentator and visiting M.I.T. lecturer Edwin Diamond notes that after remaining largely unused, New York's public access CATV channels were filled with from 20 to 25 hours of programming (including repeat programming) by late in 1972. "But," Diamond states,"the obstacles to full community participation remained high---not only lack of money, organization and technical skill but the limitations inherent in cable's status as a relatively unwatched medium."

And despite many promises and glowing reports about cable television as a two-way communication medium, no two-way services are yet available commercially to the general public, nor have two-way systems been installed except on an extremely limited experimental basis.

THE REGULATION OF CABLE TELEVISION:

(see Appendices C and D for detailed discussion of Federal and State cable regulation)

Cable has traditionally been regulated at two levels. The Federal Communications Commission (F.C.C.) has set rules at the federal level; and local governments, which control the rights-of-way over or through which cable must be laid, have regulated and franchised cable systems at the local level. Only recently

have states, including the Commonwealth of Massachusetts, intro
duced a third level of regulation.

While Boston alone can decide whether or not a CATV system
should be developed and by whom, the federal government reviews
the franchise, grants or denies the essential Certificate of
Compliance to cable operators, and limits the amount of money a
city can charge an operator for the right to lay cable in its
streets.

Although the FCC does not specifically define the role of t
states in regulating cable, it has made it clear that the approv
of existing state cable regulatory bodies will be required befor
Certificates of Compliance are granted.

FEDERAL REGULATION OF CABLE:

Until recently, the Federal Communications Commission, unde
pressure from over-the-air broadcasters who saw CATV as a threat
held that cable systems in the top 100 television markets could
import the broadcast signals of distant cities. Since 90% of th
country's television-owning households are in the top 100 market
FCC's rule was a major impediment to CATV's growth.

But on March 31, 1972, the FCC relaxed its regulation of ca
to allow a limited importation of distant television signals int
50 biggest markets. The new regulations are viewed as the rules
let CATV into the nation's cities and recognize it as a signific
communications medium.

The complex and lengthy regulations focus on four general a:

1. Carriage of over-the-air (broadcast) signals
2. Cablecasting (local origination over the cable and access to cable channels)

3. Technical standards

4. Regulatory authority (federal, state and local)

Carriage of Over-the-Air Signals:

As the nation's 6th biggest television market, Boston is covered by those regulations that apply to the top 50 markets. A Boston cable system would be permitted, or if requested by the stations, required to carry channels 2 (WGBH), 4 (WBZ), 5 (WCVB), 7(WNAC), 27 (WSMW), 38 (WSBK), 44 (WEBX, and 56 (WKBG). In addition the system could (or if requested, must) carry all other over-the-air channels that are significantly viewed in Boston. The system would have to carry at least the three local network channels, and it could import two additional independent channels (probably from New York City) so long as none of these channels duplicated programming already shown on local broadcast channels.

A Boston cable system could also import any number of non-English language channels but would be forbidden from importing the distant signal of a program that was licensed or sold as a "syndicated" program.

Cablecasting:

The new FCC regulations regarding non-broadcast channels, local origination and access come under the general heading of cablecasting.

The FCC rules prohibit any cable systems serving 3500 or more subscribers from carrying over-the-air television signals unless they also provide a significant amount of local-

ly originated cablecasting beyond simple automated weather readings and stock market reports.

Cable systems must also provide one free channel for educational purposes, one for use by local government, and one for public access. The government and educational channe must remain available without cost to the city for at least five years after the completion of construction of a main tru cable, at which time it is up to the FCC to determine whether or not such free channel use should be expanded or ended.

FCC Technical Standards:

Although the Federal Communications Commission indicate that its rules on technical standards for cable are to be ex- panded, certain minimal standards are applied to the retrans- mission of broadcast signals.

Regulatory Authority - Federal, State and Local:

As already noted in this section, the FCC rules outline what is primarily a dual system of cable regulation at the federal and local levels, while in practice acknowledging the role that the states are beginning to play in controlling CATV

The new FCC rules limit the franchise fee imposed by loc government to 3-5% of a cable operator's gross subscriber reve This limitation has angered many municipal officials who argue the cities themselves should determine what their rights-of-wa worth. While FCC Chairman Dean Burch recently said he tends t agree with the city officials, he noted his belief that the vi bility of the CATV industry is of greater concern today.[1]

---

1. Chairman Dean Burch speaking at the National League of Citi U. S. Conference of Mayors meeting in New York, February 5,

STATE CABLE REGULATION:

Although a number of Massachusetts cities and towns granted cable franchises before 1971, it is doubtful that their authority to do so existed prior to the enactment of Chapter 166A of the Massachusetts General Laws (November 1971), the State's cable television law.

This statute empowers municipalities to authorize the installation and operation of CATV systems, and defines Boston's cable franchise issuing authority as the Mayor.

The State law also creates a Community Antenna Television Commission with state-wide regulatory power. The CATV Commission is comprised of seven members who are appointed by, and serve coterminously with the Governor. The members are:

-Chairman Morton Aronson, an attorney from Needham
-Charles Beard, a Model Cities Official from Boston
-Hyman Goldin, a Boston Univ. communications professor from Swampscott
-Winifred Gorlin, a Massachusetts Consumers' Council member from Weston
-Anthony Oettinger, a Harvard computer expert from Belmont
-Francis Reintjes, Director of M.I.T.'s Electronic Systems Lab
-Donald Thurston, President of Berkshire Broadcasting from North Adams

Jeffrey Forbes, a former assistant to House Minority Leader Francis Hatch, serves as the Commission's executive director.

The cable law provides that each city and town must grant a non-exclusive cable license before the construction or operation of a cable system can begin, and no license can be granted until the issuing authority has held a public hearing on the matter.

Applications, which are to be filed on detailed forms pr by the State CATV Commission, must provide information concer applicant's character, finance, technical qualifications, subs fees (which cannot exceed $7.00 a month), etc. Applicants must to provide cable service without charge to certain public buil indemnify the City against any claims for damage or injury res from system construction or operation, insure the City and ass certain other responsibilities.

When the franchise application is filed with the issuing it is to be accompanied by a $100 filing fee. Once the license granted, the holder must pay an annual fee to both the issuing and the Commonwealth of 50¢ per subscriber served, or not less $250.

An aggrieved franchise applicant can appeal to the CATV C which after holding a hearing of all interested parties, may r the issuing authority (although it cannot actually issue a fra

Franchises are limited to a maximum term of 15 years and c be assigned or transferred without the prior written approval c issuing authority. A franchise may be renewed for up to a 10 ye period, and may, after a hearing, be revoked by either the issu authority or the Massachusetts CATV Commission for specific rea (including failure to fulfill terms of the franchise, false sta contained in the application, etc.).

STATE PROCEDURAL REGULATIONS:

On March 21, 1973, the State Cable Commission's "Procedura Regulations for Granting Community Antenna Television Licenses" effective, ending a six-month moritorium on the granting of fra

The Procedural Regulations stipulate that the franchising can be initiated by:

A) a determination of the issuing authority;
B) the filing of a completed application (and fee) by a potential licensee, or
C) a petition signed by 500 registered voters who reside in the city.

Within 60 days of any initiative, the issuing authority must decide whether the licensing process should be undertaken, and before the decision is made,public hearings must be held. If it is decided not to undertake the franchising process, the issuing authority must render with its decision, a written, public report specifying why not. Such a decision is considered a denial of any application(s) already filed. License applicants aggrieved by such a decision may appeal to the CATV Commission.

If the issuing authority decides to go ahead with franchising it must advertise for additional license applications and, within 18 months, either choose one or more applicants or reject all.

Further, if a decision to go ahead is made, the issuing authority must appoint a Cable Advisory Committee, whose membership is to reflect the social, political, educational, and cultural makeup of the city, including, if possible, a telecommunications expert.

The Cable Advisory Committee's functions include informing and educating the public, preparing an assessment of the community's cable needs, and formulating written policy recommendations. The Committee is charged, too, with the responsibility of obtaining broad community participation in its study of cable.

The Cable Advisory Committee is to file its report with the issuing authority, which is to again hold hearings before rendering another report taking into account the Committee's findings, any addenda filed by interested parties, and testimony elicited at the hearings.

When all the necessary hearings and reports have been completed, the issuing authority must invite applicants to revise their applications and solicit new applications, all to be filed by a specific date. After the filing deadline, the issuing authority must hold more hearings before it can approve or disapprove each applicant for a provisional license. The provisional license can be revoked for cause, and a final license can be granted after the provisional licensee has shown substantial compliance with the State cable law and regulations, and with the terms of the franchise.

THE TECHNOLOGICAL CLIMATE OF CABLE:

The coaxial cable technology central to the CATV industry has undergone substantial changes in recent years. The use of larger cables, better amplifiers, and converters insure greater channel capacity, clearer reception and more flexibility in system design. Most recent advances suggest that a capacity of 30 channels is economically possible, and a well-designed state of the art system developed within the next five years would probably not be outmoded for a decade or so.

However, there is a likelihood that eventual developments in CATV technology, or in the technologies competing with cable (such as telephone, microwave, milliwave, fibre optics, etc.) could out-date present equipment. For example, if microwave technology advan rapidly, in five years the City might be able to get the equivalent of a cable system without the expense or inconvenience of laying ca under downtown streets.

Over-the-air television (especially UHF), combined with video cassettes may be as good as cable for educational programming and commercial training; advanced telephone facilities may provide a reasonable alternative for many data transmission applications. (See Appendix "What Belongs on the Cable?")

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1. The New England Telephone Company already has underground duct space capable of accommodating coaxial cable in many parts of the City. The Telephone Company has indicated that its rental charge for such space is $3,000 per mile per year.

Given the uncertainty of future developments in cable technology, M.I.T.'s Electronic Systems Laboratory suggests that the City plan a cable system with an eye towards future add-on capability.[1]

Unfortunately, the cost-effectiveness of most exciting CATV services and uses remains unproven as companies continue to experiment with cable equipment.

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1. In their "Recommendations Concerning Preparations Toward a CATV System for Boston," (June 2, 1972), J.F.Reintjes and J.E. Ward noted that "The recommended cable system implementation for the City of Boston is a dual-cable system , with upstream capability on at least one cable. This will provide both the program distribution capability needed initially (using one cable with converters or both cables without converters), and the maximum flexibility for future growth to as many as 40 program distribution channels plus adequate two-way data services and upstream TV channels. (Note that because of a number of complex technical considerations, a dual-cable system has considerably more than twice the potential upstream-downstream capacity of a single system, such as now installed in New York City, and much more flexibility in division of the total channel capacity between upstream and downstream.) The total usable bandwidth on both cables in the dual-cable system should be as high as the state-of-the-art permits (currently 300 MHz) at the time of construction, again to provide the maximum flexibility for future growth in services as new channel usage techniques and equipments evolve.

"It is futher recommended that whether the City of Boston is covered by a single franchise or by several franchises, the cable network should be planned as a hub system (or systems) such that each city district (defined on a basis yet to be established) has its own separate cable trunk from the head-end where signal content can be controlled. The purpose of this requirement is (1) to permit the dissemination of all non-broadcast TV programs or services on a selective basis; (2) to permit complete freedom in the re-use of non-broadcast TV channels by district; and (3) to provide the greatest capability for future growth in two-way services. In connection with (3), note that whatever eventual two-way capacity per trunk is feasible technically, the simultaneous capacity for the city as a whole will be that capacity multiplied by the number of independent trunks. Note also that if a single franchise is granted, coordination of viewing channels and data services on the various trunks can easily be handled by the single franchisee. If, however, multiple franchises are granted, there obviously will be requirements for viewing-channel and data-channel interconnections between systems to meet the goals stated above. These requirements must be determined by the City and specified in the franchise agreements."

THE ECONOMIC CLIMATE OF CABLE:

Early cable systems in rural areas offered better (often only) reception to their subscribers. These small systems oft sold their services to 90% or 100% of the households, and the operators frequently realized large returns on modest investme in a large antenna and overhead single cable wiring.

But the economics of the cable industry have changed. No only have the costs of labor and materials soared; as cable TV moves to the cities and suburbs operators have encountered the added cost of underground wiring, internal wiring in apartment buildings, and vandalism. Moreover, many of the urban centers being wired for cable already have adequate reception and five more channels. Operators in such places will have to do more attract business. They will have to offer imported channels a otherwise unavailable entertainment packages, and will have to to the cost of system development the expense of relaying dist channels, providing sports and movie channels, providing local originated programming, laying dual or even triple cables, and especially in urban areas, meeting the local requirements of u ground wiring. All of this adds up to higher costs for the co sumer.

Some have argued that, despite the added expenses of deve cable systems in the cities, urban density, diverse cultural d and potential commercial users of cable can make an urban CATV chise a virtual "license to print money." But the two cable sy franchised to operate in New York City have had very different experiences.

A subscriber penetration rate of 30% after three years of system operation is generally considered the point at which cable becomes economically viable in most major cities. However, the Sterling Manhattan Cable TV Company, with more than 31% penetration after seven years of operation, recently announced that it is losing money and requesting that the City of New York grant a 62.5% increase in subscriber fees and a 100% increase in converter rental charges.[1]

Sterling, whose densely-populated franchise area has very poor over-the-air TV reception, reported losses of $3.7 million for the year ending March 31, 1972. In a March 22, 1973 article in The Village Voice, Sterling president Richard Galkin stated, "We have not gotten the customer acceptance we want. We expected 50% [of the area households to sign up for cable]; got 31%."

Would a cable system in Boston fare any better, considering that the city already has all three TV networks on VHF, three UHF channels (two offering sports coverage), one of the best educational channels in the nation (Channel 2), and a large and expanding movie theatre industry? Moreover, many homes in Boston can receive clear signals from New Hampshire, Worcester, and the Providence-New Bedford area. The city's relatively good reception and large number of channels reduce its natural demand for the clarity and abundance of cable TV. Recognizing the limited services of existing CATV systems, why would a significant proportion of Boston's consumers pay more than $5.^{00}$ a month for cable?

At the Boston Consumers' Council's cable hearings in October of 1972, Frank Whyte of Foundation '70 (a cable TV research organizat-

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1. TelePrompTer, the huge multi-system company that operates New York's other CATV system, has suffered severe financial difficulties and was recently suspended from stock trading for more than two months. It, too, is expected to seek a large rate increase.

ion based in Newton), spoke about possible cable subscriber pe tration in Boston. Noting that his group has simulated the ec mic behavior of cable systems in the City, Whyte said "it is dramatic to recognize that there are neighborhoods in... Bosto are far more economically viable than the cities and towns in t rest of the Commonwealth."

Mr. Whyte acknowledged,however, that such factors as the s quality in various parts of the City and the difficulty cable o ators might have in gaining wiring access to apartment building not been considered in the Foundation'70 projections.

George Duffy, president of Colonial Cablevision of Woburn, at the hearings that good reception is the most important and m able service a cable operator has to offer. He noted, too, that on analyses by his company, over-the-air reception in Boston is erally quite good.

As an economic proposition, a traditional cable system in B ton might be marginally viable. There is some indication that t development of a traditional system in the City may be risky, although a few system operators have expressed interest in obta a Boston cable license. There is further indication (based on cussion with CATV operators and the fact that no potential appli has taken steps to push the City into the franchising process) t while some major operators would feel compelled to bid on as imp ant a system as Boston's, the operators are actually hoping that City will not go ahead with franchising at this time; the viabil of the Boston market is so uncertain and the investment so great.

This is not to say that if the 30% penetration rate (genera

seen as necessary in an urban market) were realized the traditional system operator would not make a substantial profit over the long run. Over the ten or fifteen year term of a franchise the system probably would be profitable.

If, however, any other services such as premium (pay) TV, leased lines to institutional users or common carrier channels were developed, and there were little or no regulation of rates for any substantial period of time, the economic picture would change dramatically, and the 30% penetration rate might not be necessary. If 10% of the potential subscribers were to pay $5.00 a month extra for 2-4 channels of sports and first-run movies, the system operator would gross $1.3 million and net about $500,000.

Further, it should be noted when considering the large amount of capital needed to construct a system, that most cable operators put up only one-third of the actual cost, the remainder usually being in the form of bank loans. The profit on a system may seem small as a portion of the gross investment or gross revenues, but as a portion of the equity investment it may be substantial---25% per year profit on actual equity investment after the early losing years. The profits of later years can be sheltered against taxes.

Although the estimated $20-$40 million system construction cost may be considered large, it should be contrasted with the cost of building a downtown office building, or the City's annual capital budget. It then seems a bargain for control of a major communications network.

Historically, cable operators have drained whatever profits a particular franchise area might yield in order to acquire licenses in

other cities. The pattern results in multiple-system-operato having sunk so much money into acquisitions that services in system remain disappointing while subscriber rates stay artif high.

Each applicant for a cable license in Boston will be mak own analysis of potential penetration. If the system were to privately owned and an operator were to find that he could no the saturation he anticipated, he would be forced to either s increase in subscription fee rates, cut services, or get out cable business in Boston. The Consumers' Council guesses tha the uncertainty of profitability in this City, subscribers wo wise to expect limited services, and possible fee increases.

are likely to pressure the Mayor to grant increased subs tion rates, while consumers demand increased, and perhaps muni financed, services. The Mayor will have to determine if a rat increase reflects a genuine increase in operating costs, or if actually being used to subsidize the operator's desire to acqu other franchises.

Some cities have seen cable as a source of revenues in th form of franchise fees paid to the municipality by the cable s operators. Buffalo, New York, for example, is paid 5% of its system operator's annual gross revenues. Columbus, Ohio gets Philadelphia gets 5% and other cities collect as much as 36% o gross cable revenues.[1]

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1. Walter S. Baer, Cable Television: A Handbook for Decisionma (The Rand Corporation, 1973), p.112.

However, the new FCC rules limit franchise fees to 3%-5% of an operator's gross revenues, and the Massachusetts cable law limits municipal fees to fifty cents per subscriber per year. Under these regulations cable can never be a significant revenue producer for Boston.[1] Even if 30% of all Boston households were to subscribe to cable, the City would receive only $37,500 a year in fees. This would hardly cover the costs of regulating a CATV system: it would not be sufficient to pay the costs of such municipal cable uses as educational programming, water metering or TV links between hospitals and the neighborhood health centers.

THE OWNERSHIP ISSUE:

Existing cable television systems are almost universally privately owned and operated under municipally issued licenses. In fact, most cities have not even considered any other ownership approaches.

There are actually two aspects of the cable ownership issue that need to be considered:

1. What must be owned?
2. Who should own it?

All the equipment, cables, physical plant, and most of the programming must be owned by someone. At its April 6, 1973 meeting, the Massachusetts Cable Commission took the lead on a sensitive and controversial notion currently being considered by the FCC and

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1. While the Massachusetts cable law limits the fees to be paid to cities for processing cable license applications to $100, major cities outside the Commonwealth have established application fees which ensure sufficient funds to assess bids without cost to the municipality. Kansas City was considering a $1,500 application plus a $100,000 franchise acceptance fee. Bloomington, Minnesota charges a $25,000 acceptance fee to defray administrative expenses and the costs of programming municipal CATV channels.

the White House's Office of Telecommunications Policy. The C
ission adopted as a policy objective the separation of ownersh
of cable hardware (plant and equipment) from the ownership of
programming.

Many analysts feel that the major alternative to total p
ownership of cable is the concept of cable as a common-carrie
ty .[1] Under such an arrangement, ownership of the physical as
is separated from ownership of programming, with channel usage
able on a first come - first serve basis. One programmer migh
retransmissions of over-the-air programs to areas of the City
better reception is needed; another might have premium T.V. or
ity programming with advertising.

The utility type system could be built by a private inves
group, another utility (such as the telephone company) or by a
public or non-profit corporation. A variation of the utility
is public ownership of the system with a public corporation de
to allocate channels and set rates. This option becomes
ant to consider separately if cable is in fact to become the ma
communications medium within and among cities.

Who owns the cable system also hinges on whether the City
offer one or many franchises. Advocates of multiple franchises
that many franchises provide (1) greater opportunity for s
local, minority oriented organizations to get into cable, (2) b
competition which may enhance quality, and (3) greater oppor
to meet the communications needs of small "communities of inter
Opponents to multiple franchises point out that having many fra
requires dividing the City up into districts of equal economic
ity---a task that may be impossible to achieve. They argue, too

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1. Cf. Steven R. Rivkin, "Changing Signals of Cable," Georgetow
Law Review, (Volume 60, No. 6, June 1972).

whatever competition a multiple franchise system might provide would be derived from the presence of CATV systems in surrounding cities and towns; that dividing the City into neighborhood cable districts risks creating "electronic ghettos;" and that having a single franchise is both technically and administratively "neater."

Whether local applicants should be considered preferentially and whether all franchise applicants should be required to provide significant opportunity for citizen participation in ownership remain as additional issues, particularly in the light of the current trend towards the merger of cable companies into large conglomerates. Will a multiple -system-operator, with headquarters in New York or Los Angeles, show adequate concern about providing job opportunities and community access programming in its Boston branch (especially if its Boston system is less profitable than those in other cities)?

BOSTON'S CITIZENS ON CATV--

THE CONSUMERS' COUNCIL'S CABLE HEARINGS:

During the first two weeks of October 1972, the Boston Consumers' Council held a series of public hearings on cable television development in Boston. The purpose of the hearings was to provide the public with an opportunity to air their views and give the City a sense of the public's concerns before going ahead with franchising.

Although the hearings were announced on television, reported in the papers, and advertised on the second page of both the City's daily newspapers, attendance was sparse. Most of the people who

came had a vested interest in cable's development: they were either cable operators, potential applicants, consultants, or representatives of institutions that would possibly engage in programming.

Most expressed distrust of the City's motives, and many that the City Administration undertake an effort to educate r before any decisions on cable are made.

The few citizens attending the hearings who did not fall the categories discussed above tended to express concern abou not opposition to, cable development. A woman from Roxbury w what cable's development would do to "free" TV, her utilit the environment and her taxes. She remarked that "The poor c pay any more payments....Who will pay for all the educational grams? Will all taxpayers pay, even if they don't have cable?

Speakers from P.A.N.I.C. (People Against National Identit Cards) noted their absolute opposition to CATV, citing its use public surveillance and market analysis, and its intrusion on sonal privacy.

Certainly the cable hearings offered no mandate for CATV ment in Boston. Nor, for that matter, did they offer a clear of how cable advocates believe cable should develop here.

Robert Coard, Director of A.B.C.D. (Action for Boston Com Development), urged that cable be developed to serve the City' to provide jobs and job information, educational opportunities low-cost advertising opportunities for small businesses. Coar that A.B.C.D. believes in the integrity of Boston's existing n hoods, and feels that a cable system should be divided into mu franchises along existing neighborhood boundaries.

Speaking on cable ownership, Coard said he favored a "mixed kind of approach, perhaps with many community-controlled corp

Richard Burns of Charles River Partnership, spoke in favor of a city-owned cable system, noting that if a franchise were held privately, over the years the City would lose control of cable. He suggested that a system be built and managed by a private contractor, but owned by the municipality.

Gerald Bush, Director of the City's Economic Development and Industrial Commission, suggested that a CATV system in Boston could have positive ramifications on the City's economy, creating new jobs, establishing new investment opportunities and enhancing the communications facilities of the City.

Thomas Rivera of C.A.T.V.I.S. (Cable Antenna Television Information Service), citing FCC and judicial rulings, argued that "In addition to fulfilling the financial, legal, and technical requirements, local ownership and control are essential criteria which must be met in order to produce a franchise capable of meeting community needs and satisfying the public interest."

Charles Grigsby, President of Roxbury Cablevision, spoke on franchising procedure and ownership. Grigsby said that among the important criteria the City should use in evaluating applicants are:

1. Diversification of ownership
2. Amount of time owners are willing to put into system management
3. Innovations proposed by the applicant
4. Degree to which applicant will provide jobs for residents
5. Degree of local and minority ownership and participation

Grigsby noted, too, that he favors a joint venture between a large operator and a small operator, with only one, or at most, two franchises in the City.

The Consumers' Council's year of experience with the CA issue and the cable hearings offers no clear answers as to wh or not the people of Boston need or want cable television. A consumer protection agency, the Council fears that citizens w have no particular interest in CATV will find themselves capt by talk of cable's exciting, but undemonstrated, potential an barraged by a sales campaign for a product whose actual value be enormously exaggerated.

THE RECOMMENDATIONS OF THE CONSUMERS' COUNCIL:

The Boston Consumers' Council feels there are a number of alternative approaches to cable that the City could take at this time:

1. Franchise a single operator to build a city-wide cable system,
2. Franchise several operators to develop an interconnected city-wide network of cable systems,
3. Undertake the development of a municipally-owned city-wide cable system,
4. Develop either a municipally or privately-owned, small experimental cable system, or
5. Postpone cable development until many of the issues discussed previously in this report have been clarified.

▶ The Consumers' Council feels strongly that either limiting cable development at this time to an experimental undertaking (alternative #4), or postponing franchising (alternative #5) are wise, viable options.

▶ The Council feels that postponement is a laudable approach given the history of cable, which is roughly analagous to that of the SST. Debates on both issues reveal an exaggerated and uncertain technology, and an indefinite market.

▶ The Consumers' Council believes that even if a decision to postpone cable franchising is made, the City must continue to keep abreast of cable (and competing technology) advances, and support beneficial regulatory changes.

Just as the Consumers' Council advises consumers to be suspicious of the door-to-door salesman who proclaims the wonders of his new, untried product, it advises that the City approach cable television cautiously.

There is no question that the potential of cable is significant. Cable advocates promise two-way communications; new programming (including a great deal of public interest programming); a medium for the delivery of community services; a vehicle for community planning, dialogue and decision-making; and a highly profitable investment.

But the Consumers' Council notices an enormous disparity between what CATV can potentially do and the services that are actually being provided. Even advanced urban cable systems rema one-way, almost entirely devoted to the retransmission of over-the-air television, and rarely used for the delivery of communi services or as a vehicle for community participation.

The experience of the Sterling Manhattan Cable system in N York City suggests further that urban cable may not generate th revenue needed to develop attractive programming packages unles additional charges are imposed on subscribers.

Although it is developing at an astounding rate, cable tec nology remains exaggerated and uncertain, while the possibility of using other, competing technologies for many of the City's existing communications needs remains largely unexplored.

Just as the technology of cable has failed to reach maturit cable regulation at both the federal and state levels has not matured to the point where it can serve the needs and interests

of the City.

At a February 1973 meeting of the National League of Cities and United States Conference of Mayors, many officials expressed the feeling that it would be unwise to rush into CATV franchising before developing basic municipal telecommunications plans and achieving a healthier regulatory climate.

Discussion at the NLC/USCM meeting focused particularly on the FCC rule that limits franchise fees which may be imposed by city government to 3%-5% of a cable operator's gross subscriber revenues. San Diego City Attorney John Witt noted at the conference, "The franchise fee is compensation for use of city streets and not, as the [cable] industry views it, a tax. It is rent, not a tax. Our regard should be: 'What is the right [to use city streets] worth?' and not 'What will the regulatory costs be to cover the franchise?'"

Cities have a major responsibility to regulate cable after a franchise is granted. Although only a small part of the city is wired for cable, New York's regulatory body operates on a $250,000 a year budget and has responsibility for enforcing the franchise, preparing franchise revisions, overseeing and assuring access to the system, developing use of the governmental channel, etc.

As already noted, Massachusetts law further limits franchise fees, thereby imposing an unusually severe restraint on the City's ability to regulate cable without relying on already overburdened municipal coffers, and its right to be reasonably compensated for the use of City streets.

Cable economics, especially in the light of the State cable law,

weigh heavily on the questions raised by the Roxbury woman at Consumers' Council's cable hearings. Given the disappointing e ience of New York's seven-year-old cable system, the revenue l ations imposed by the FCC rules and the State cable law, and t questionable viability of the Boston market, who will pay for educational, municipal and community programming?

Other important cable issues remain unresolved. While man consider the views expressed by P.A.N.I.C. to be extreme, the Consumers' Council believes the possibility that a CATV system be used for unauthorized subscriber monitoring or surveillance a major problem that must be addressed before cable is introduc in Boston. It is the consensus of the Council that a Boston fra chise must contain rules prohibiting CATV monitoring without subscribers' consent, that the City should support legislation making the invasion of privacy by cable a criminal offense puni by fine and/or imprisonment, and that (as soon as the state-of- art permits) a technical means of insuring that unauthorized ta or subscriber monitoring does not occur be installed at the ope expense.

Noting that the traditional cable system is usually owned, operated and programmed by the same entity, the Consumers' Counc feels that a conflict of interest exists: owning physical assets (the hardware of a CATV system) and owning the programs are diff roles which are, to some degree, in conflict since the owner of physical assets has the power to allocate those assets among com ing users. The Consumers' Council feels it is essential for the City to consider separating the ownership of cable plant from ow

ship of programming and services, and consider supporting a total common-carrier approach to cable.

When programming and services are separated from ownership of the system hardware, the City must address two different kinds of franchises. One is for the operation of the system hardware. Reasons of compatibility, ease of interconnection, and uniformity of quality suggest that there should be one such franchise city-wide. The other kind of franchise would permit channel use and programming; many such franchises would be desireable for their diversity.

In a total common-carrier system, as noted earlier in this report, the owner of the CATV hardware would lease channels to programmers for a set fee on a first-come, first-serve basis.

The Consumers' Council does not favor, if the City were to take a traditional approach to franchising, dividing Boston into a number of franchise districts, each with its own CATV operator. Dividing the City equitably, the Council believes, is an impossible task, and the cost to the consumer of paying for multiple system administrations, service vehicles, etc., would be inflated.

The Council does feel, however, that while overall system quality and service standards are most important, local participation in ownership should be encouraged.

While it questions whether the City is in either a legal or fiscal position to undertake such a project, the Consumers' Council feels that Boston should thoroughly explore the notion of owning a city-wide cable system itself---perhaps contracting with a firm to build and manage the system on a set fee basis, and designating an authority with broad community representation to administer the system.

APPENDIX A

WHAT IS CATV?

APPENDIX A

WHAT IS CATV:

In the technology of conventional television, T.V. programs are recorded by sophisticated television cameras which encode the program into electronic signals. When these electronic signals reach a television set (the receiver) they are decoded and the final product is the fluid video and audio program received on the television screen.

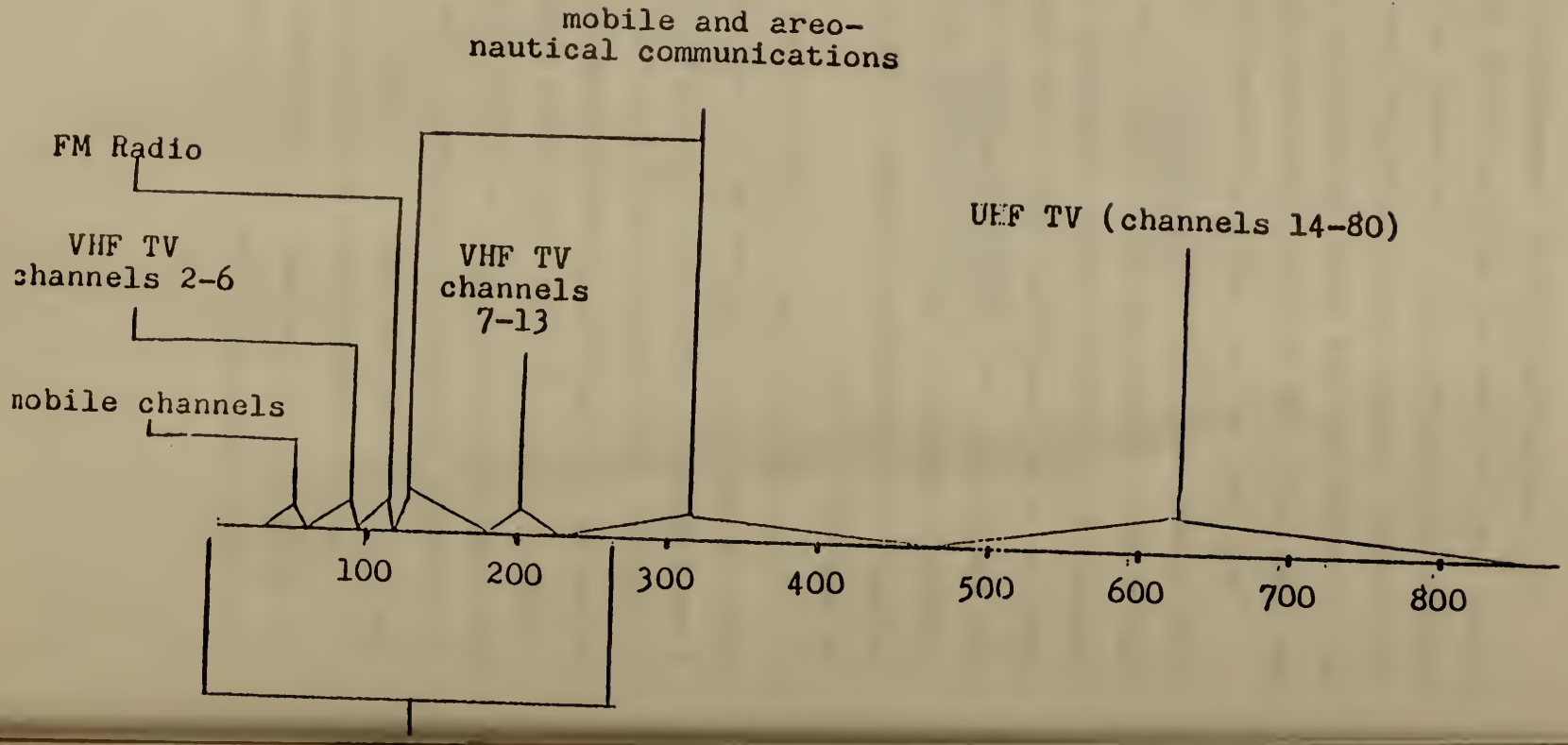
But how do the coded electronic signals of the TV program reach the television set from the television camera? The electronic signals of the program are carried by wire to a transmitting antenna which transmits the signals over the air upon an electromagnetic wave. The signals can be received by any television set that is tuned to the appropritate wavelength (channel selector) and is located within the perimeter of the signals' transmitting strength. This type of signal is known as broadcasting.

The natural laws of electronics restrict television signals to certain frequencies of the electromagnetic spectrum (See Figure 1). The optimum frequencies comprise the Very High Frequency (VHF) band, which only has room to accomodate 12 television channels. Another frequency band lies above VHF which is known as the Ultra High Frequency (UHF) band. The UHF band can accommodate an additional 70 channels, but due to certain electronic phenomena the quality of the reception received on the UHF band is inferior to that of the VHF.

In the transmission of TV signals, there is a great deal of interference between signals which travel upon or around the same wavelength. Due to this extreme interference between

Figure 1

RANGE OF RADIO AND TELEVISION BROADCAST FREQUENCIES
IN MEGACYCLES PER SECOND (MHz)



TV signals, the Federal Communications Commission has had to limit the number of television signal transmitters in the continental United States. The FCC attempted to allocate these TV transmitters in such a way as to benefit the maximum number of people. This allocation has resulted today in providing 97 percent of American households with at least one TV channel. The average number of channels that can be received throughout America is five. Thus, the amount of programming that can be broadcast over the air is greatly limited by: (1) restrictions on the frequency levels that are capable of transmitting television signals, and (2) the extreme inter ference that occurs between signals, which further limits transmission of signals.

In the present technology of cable television, the television program signals are transmitted through a solid conduit known as a coaxial cable. A coaxial cable consists of an inner conductor, an outer conductor, a sheath of plastic foam (which separates the two conductors and maintains an electric field between them), and an outer protective sheathing. Such a coaxial cable is capapble of supplying to a receiver the equivalent of at least 20 TV channels.

Every television set that is a part of the cable system is directly connected by coaxial cable to the hub of the cable system which is known as the head-end. The head-end consists of antenna, pre-amplifiers, convertors, and signal levelers. The configuration of the cable system from the head-end to the television set is often compared to a tree. The main trunk cable runs along the major routes to be covered and from its branches feeder cables, which are installed within approximately

75-100 feet of each residence. Branching off from the feeder lines are smaller cables called drop lines which are connecte directly to each television set (See Figure 2)*

There are two ways for the cable system to receive television signals: (1) by picking local conventional TV signals out of the air with the antennas of the head-end or by having long distance TV signals relayed to the head-end's antenna by means of a microwave, or (2) by establishing TV production facilities at the head-end and originating and distributing programs over cable only directly from the static

Conventional single cable systems are capable of carrying approximately 20 TV channels. This capacity is only limited by the present technology of signal amplifiers. These amplifiers are placed along-side the coaxial cable at 1/3 mile intervals in order to maintain the strength of the TV signals.

Theoretically the cable should be able to carry 40 channe and this potential should be realized with more research in the area of amplification.

Cable TV can carry more channels than conventional television because it can use frequencies that conventional TV cannot. Cable television is capable of using the entire frequency spectrum. A single cable is capable of using the frequency range which runs from approximately 3 megacycles per second (MHz) to approximately 270 Mhz. This frequency range allows the cable to use all of the VHF channels plus the frequencies which lie between channels 6 and 7 (midband channe and the frequencies which lie below channel 2(sub band channel See Figure 1). A multi-cable system could carry any number of channels employed per cable.

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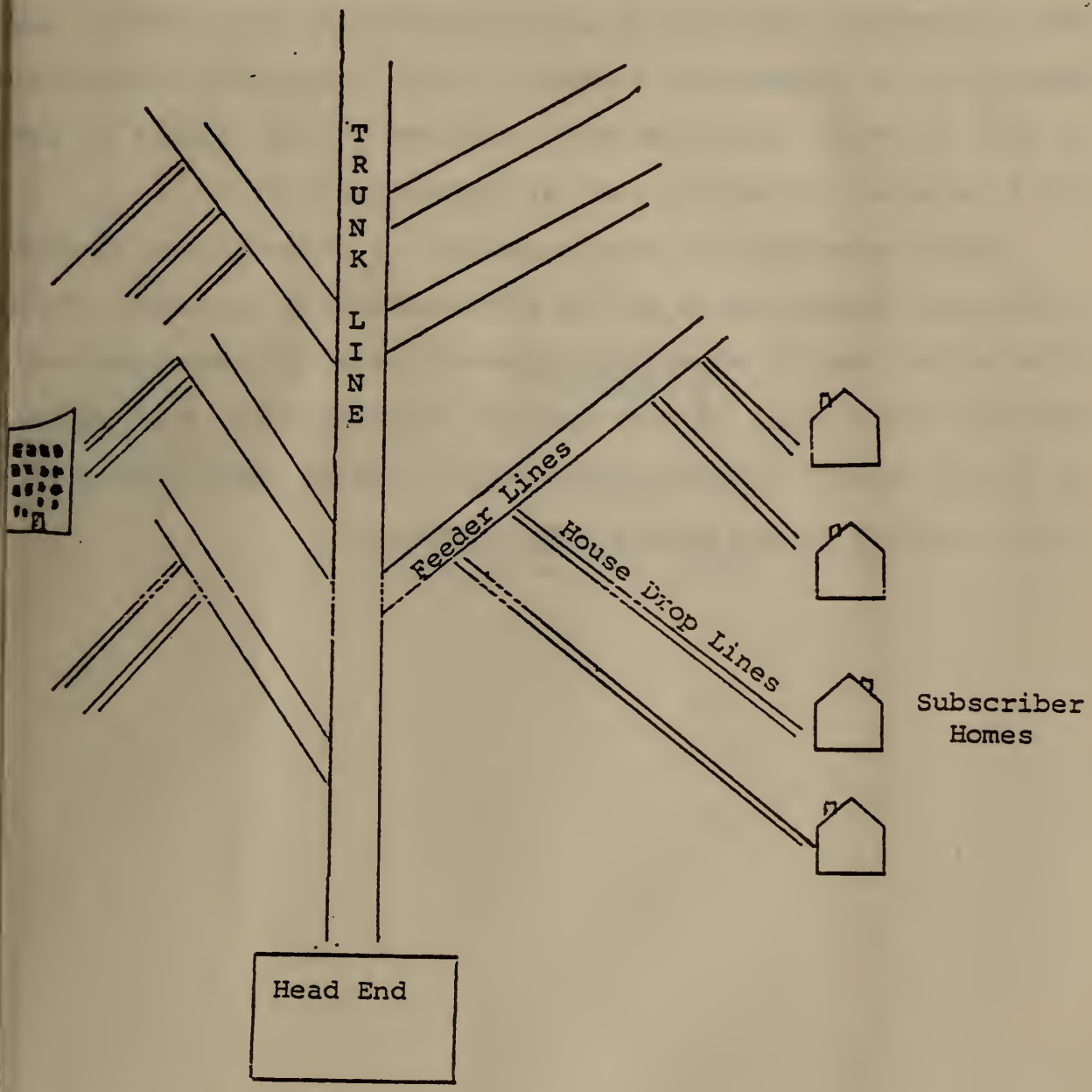
*This tree-like configuration is presently the most popular. However, there are other types of configurations which are more sophisticated and versatile.

FIGURE 2

A CABLE SYSTEM CONFIGURATION



Due to interference, conventional broadcast television signals are often received in the form of ghost images on black a white television sets and color distortions on color sets. Cable because it is transmitted through a cable rather than over-the-air is able to avoid these reception problems and is capable of providing a superior picture to that of conventional TV.

Cable television is also superior to conventional TV because it does not demand space on the electromagnetic spectrum. Television signals that are broadcast over-the-air take up space that could be used for other types of over-the-air transmissions, such as: aircraft to ground control installations, ship-to-shore communications, taxi police cars, fire and police radio, etc.

APPENDIX B

Cable Television: A Brief History

APPENDIX B

THE HISTORY OF THE CABLE TV INDUSTRY

The cable television industry began in the rural regions of Pennsylvania and Oregon a little over 20 years ago. Due to hilly topography of these regions or their distance from over air transmitters, the area residents were unable to receive t vision signals.

Noting the demand for the TV programs which were being c received in the less mountainous and more urban regions, loca entrepreneurs erected large antennas on high ground. These an were capable of clearly receiving the TV signals of distant t mitting stations. These "cable pioneers" then connected the h of the local residents with the master antenna by stringing c cable upon poles from the master antenna to each individual h that desired a hook-up (See Figure 1). Those households that subscribed to this service paid a one-time installation fee of $100. and a monthly service charge of about $3.00.

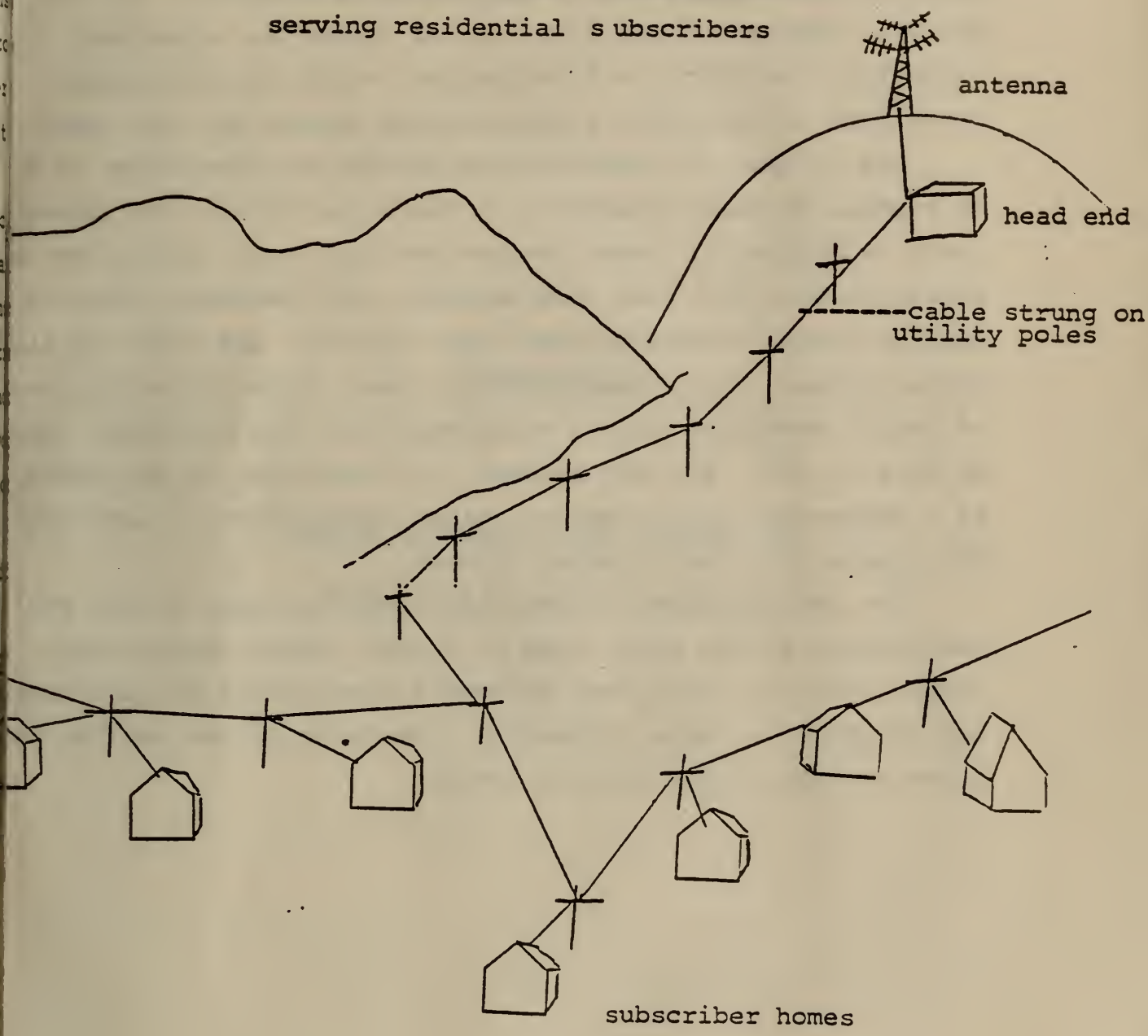
The entire cable industry has grown over the last 20 year a rapid rate. During the past few years, the rate of subscribe has grown at a rate of 20 to 25 percent annually. Pennsylvania the state where cable originated, has more than 285 cable syst In the entire United States, there are over 2500 cable systems 2300 other cable franchises have been granted with another 260 applications pending.

According to Ted Ledbetter, a leading cable TV consultant existing systems offer from 6 to 12 channels, with the average all being 10.4. The newer systems being constructed will offer 20 channels. Many systems are now capable of local origination some offer such services as local weather, news, sporting event and community service announcements.

With the rise of the cable TV industry, the ownership of m cable systems has gone from the hands of local entrepreneurs to large, sophisticated business corporations. These corporations

Figure 1

Conventional one-way cable system serving residential subscribers



referred to as multi-system operators (MSO). They have emerge in the cable industry because of a demand for larger financin sophisticated management, research and development, and most portant, because of the high rate of return on investment. The largest of the MOS's is TelePrompTer, which has substantial investment by financial tycoons Howard Hughes and Jack Kent Co

Due to past FCC prohibitions on the retransmission of dis TV signals by cable operators in the major cities, the growth cable television in urban centers has been slow. Only a few ma cities such as New York, Los Angeles, San Francisco, Seattle, Austin, Texas, presently have cable systems, and they are limi Cable systems were established in these cities primarily beca of bad TV reception due to topography and tall buildings. Howe on Mary 3, 1972, the FCC relaxed its regulation of the cable i to a degree and now allows a limited importation of long-dista TV signals into the 50 major cities.

The cable industry views this liberalization of the FCC's regulations as the first step in a more "growth stimulating" po toward cable TV. With less stringent regulations and continuing improvements in cable technology, the major cities are the futu prime markets of the cable industry.

APPENDIX C

Federal Communications Commission

Regulation of Cable Television

APPENDIX C

FEDERAL COMMUNICATIONS COMMISSION REGULATIONS:

On March 31, 1972 new FCC rules became effective that l cable into the nation's cities and recognize it as a signifi communications medium. The complex and lengthy regulations f on four general areas:

1) Carriage of over-the-air (broadcast) signals
2) Cablecasting (access and local origination)
3) Technical standards
4) Regulatory authority-federal, state and local

Carriage of Over-The-Air Signals:

As the nation's sixth biggest television market, Boston covered by those regulations that apply to the top 50 markets Boston cable system would be permitted to (or if requested by stations, required to) carry channels 2 (WGBH),4 (WBZ), 5 (WC 7 (WNAC), 27 (WSMW), 38 (WSBK), 44 WEBX), and 56 (WKBG). In a the system could (or if requested, must) carry all other over air channels that are significantly viewed in Boston. The sy would have to carry at least three local network signals and t local independent signals, and could import two additional ind signals (probably New York stations) so long as none of the pr shown on these independent duplicates programming shown on loc broadcast channels.

A Boston cable system could also import any signals of no English broadcast channels without restriction.

The FCC rules prohibit a Boston cable system from importi the distant signal of a program that was licensed or sold as a "syndicated" program ["any program sold, licensed, distributed offered to television station licenseees in more than one mark within the United States for non-connected television broadcas exhibiting but not including live presentations"] for one year

from the time the syndicated program was first licensed or sold. Nor may a system carry the imported distant signal of a program if a local broadcast station gives notice of its exclusive exhibition rights.

A proposed FCC rule would also require (upon request) a CATV system to carry all local AM & FM radio signals if any distant AM or FM signals are imported - and, if a local radio signal is carried, the system would (on request) be required to carry all other local radio signals of the same type.

An additionally proposed rule would prohibit a cable system from showing the home games of any professional Boston Athletic teams that are not carried on local broadcast TV unless the team specifically grants the cable operator permission to do so.

Cablecasting:

The new FCC regulations regarding non-broadcast channels, local origination and access come under the general heading of cablecasting.

The rules prohibit any cable systems serving 3500 or more subscribers from carrying over-the-air television signals unless they also provide a significant amount of locally originated cablecasting beyond simple automated weather and stock market reports. The channels used for local origination, the FCC specifies, must not be used for other purposes, and programming must comply with the equal time and fairness doctrines. The channels would be permitted to carry advertising by identified sponsors at the beginning and end of programs and at "natural intermission" and breaks but lotteries and obsenities are forbidden.

Cable operators are prohibited from charging extra fees (pay TV charges) in excess of the normal subscription charge for movies which have been released for more than two years prior to their cablecasting. Cable operators are prhoibited from cablecasting serial-type programs (with inter-connected plots) and from showing sports events that have been televised live on a non-subscription basis during the two years preceding the cablecast. No more than

90% of the time used for cablecasting can be used for the sho of movies and sports events.

A Boston CATV system would be required to have at least channels, and the new FCC rules stipulate that there be at le one non-broadcast channel for every over-the-air signal carri on the cable. The rules require, too, that systems in the top markets have two-way capabilities (i.e. the technical capacity for at least non-voice two-way communications).

Cable systems are required by the FCC to provide one free channel for educational purposes, one for use by the local gov ment, and one for public access. The government and educationa channels are to remain free for at least five years after comp of the main trunk line, at which time it is up to the FCC to d mine whether such free channel use should be expanded or ended.

Cable operators must provide production facilities for us the public access channel. Production costs cannot be charged the user except after the first five minutes of live studio ca casting.

While the city may petition the FCC for additional channe to be used on an experimental basis, it cannot simply require in a franchise. However, should demand on these channels exceed certain percentage of available time, the operator has six mont in which to provide an extra channel.

Those channels which are not used for the re-transmission broadcast signals, or for local origination, educational, gove mental and public access cablecasting are to be made available a common carrier basis.

Local government is prohibited from prescribing any additi rules concerning the number or manner of operation of public ac channels. It is apparently up to the system operator to determi whether or not to exceed the FCC's minimum requirements.

Public access and common carrier channels are to be made available on a first come, first serve basis. While advertising is permitted on the common carrier channels (so long as sponsor

identify themselves and system owners specify their rates), no commercial or political ads are permitted on educational or public access channels. Beyond the enforcement of these rules, and the provisions prohibiting obscenity, the cable operator must not interfere with the program content on the educational, governmental, public access or leased channels.

FCC On Technical Standards:

The technical standards set forth in the new FCC rules apply only to the re-transmission of broadcast signals and are minimal. However, the FCC indicates that these rules will be expanded.

FCC On Regulatory Authority - Federal, State, and Local:

The March 31, 1972 FCC rules outline a dual system of cable regulation involving the federal and local governments.

Boston alone decides if a CATV system should be developed and who should develop it. But once a franchise is granted the federal government reviews the franchise, determines whether or not certain procedures have been met (invitation for applications were public, applications were filed publically, hearings were held before the franchise was issued, and the decision of the franchising authority was published and released publically) before a cable system can receive the required certificate of compliance.

The rules specify that the system operator must accomplish significant construction within the first year after the certificate of compliance is grnated, and suggested that at least 20% of the franchise system be completed each year thereafter. Specific time-tables are left up to the franchise granting authority.

The FCC leaves specific subscriber rates up to the franchising authority, and disapproves of the use of franchisee fees to the local government for revenue raising. Fees to the City are to correspond with local regulatory costs.

The Commission requires that fees in excess of 3% of gross revenues be justified.

APPENDIX D

STATE REGULATION OF CABLE TELEVISION

AND

PROCEDURAL REGULATIONS TOWARDS GRANTING

A CATV LICENSE

APPENDIX D

STATE REGULATION:

Chapter 166A of the Massachusetts General Laws empowers cities and towns to authorize installation and operation of CATV systems, and defines Boston's cable franchise (license) issuing authority as the Mayor.

The State Cable Law also creates a Community Antenna Television Commission with state-wide regulatory authority. The CATV Commission is comprised of seven members appointed by the governor. The appointees serve coterminously with the governor; and are listed below:

Chairman - Morton Aronson - Needham - an attorney

Charles Beard - Boston - Ass't Admin. of Model Cities

Hyman Goldin - Swampscott - Telecommunications expert BU Professor

Winifred Gorlin - Weston - member State Consumers' Council

Anthony Oettinger - Belmont - computer expert Harvard Professor

Francis Reintjes - Belmont - Director, MIT Electronic Systems Lab

Donald Thurston - N. Adams - President, Berkshire Broadcasting

Jeffery Forbes - Exec. Director -- former Admin. Ass't. to House Minority Leader

The State Consumers' Council has the authority to represent the people of the Commonwealth in any proceeding before the Commission. The Consumers' Council is given standing as an "aggrieved party" for purposes of administrative of judicial review of a State Commission ruling.

The law requires that each city or town issue a written license before construction and operation of a CATV system begins; the Commission must receive a copy of the license; the license shall be

non-exclusive (even with one operator, single city-wide syste additional franchises could be granted) and contain the follo

- The area or areas to be served

  "Area or areas to be served" is defined in Section 1 (f) and "may include a portion of a municipality in order to reflect within municipal boundaries, the various economic, cultural, geographic and community interests of the citizens residing therein."
- The completion date of installation of all equipment, wires, and cables necessary to serve the named area or areas
- The date service shall be available to the named area or areas
- The term of the license (which shall not be more than 15 years)
- Such other terms and conditions which have been authorized by the Commission

The cable law outlines those procedures that must precede franchising:

A. There must be written application (also for renewal) on a form prescribed by the Commission (soon to be completed).

B. The form shall contain information the Commission may require as to:

   1. Citizenship and character of applicant
   2. Financial and technical qualifications necessary to operate the system
   3. Complete information as to applicant's principals and real owners
      (a) In the case of corporations, all stockholders ow more than 1%

(b) In the case of unincorporated associations, all members and ultimate owners

4. Complete information on extent and quality of service

(a) Number of channels, hours of operations, variety of programs, local coverage, safety measures, installation and subscription fees

5. Additional information the Commission considers necessary

C. Each applicant must disclose true ownership of applicant and of the equipment used to render service and source of funds for purchase, lease, rental and installation of equipment

D. Each applicant shall set forth equipment to be employed, routes or wires, area or areas to be served, approximate start and completion of construction dates, and date service will be available.

E. Additional areas may be added by supplemental application or after hearing by directions of issuing authority

The state law requires that the franchise applicant agree: To avoid unnecessary damage to trees and structures in installing and maintaining wires and equipment along the routes authorized by the issuing authority; indemnify the city from any claims for injury or damage caused by construction and operation; carry insurance to indemnify the city and itself against any claim based on damage or injury caused by construction or operation; not engage in selling or repairing TV or radio sets; provide a cable drop and an outlet along its cable routes at no cost to puboic schools, policy and fire stations, public libraries, and other public buildings designated in writing by the issuing authority; on license or renewal expiration, remove supporting structures, poles, transmission and distribution systems and other apparatus from streets, other public places in, over, under or along which they are installed; whenever pavement is taken up, replace and restore within a reasonable time.

Further, the franchise applicant must promise not to re
a subscriber's antenna; to offer, at cost, an adequate switc
device to allow the subscriber to choose between cable and n
cable reception; to notify subscribers a month ahead of the
of any signal frequencies and give them a channel marker; to
by equal time doctrines; to submit a bond with corporate sure
satisfactory to issuing authority to indemnify satisfactory c
tion and operation and other conditions before construction b
to give subscribers a credit or rebate if service interrupted
24 or more consecutive hours; to annually wire and provide se
in not less than 10% of the franchise area until work is comp
and available in all areas; to complete construction within s
years after the license is granted; and to maintain local off
or local telephone connections in the communities served.

Like the federal provisions, the state cable law stipulat
that the franchise issuing authority must hold a public hearin
before granting a license. The City must give notice of time,
and subject matter in a newspaper of general circulation once
each of two prior to the hearing.

In the event that more than one application is filed in a
city or town, the issuing authority is to choose the applicant
applicants which, in its opinion, will best serve the public i
The issuing authority must issue a public statement in writing
containing the reasons for its acceptance or rejection of any
all applicants.

The assignment and transfer of a license is only permitte
with the approval of the issuing authority, and each franchisee
must file an annual statement with the state CATV commission an
the issuing authority of its revenues and expenses, and a state
disclosing its ownership. Each franchisee must also file with t
city and state a financial balance sheet and statement of owner
which is to remain open to public review.

All franchise applicants (and franchise renewal applicants)
are required to pay a $100.00 application fee to the city. A

franchise holder must also pay an annual fee to both the Commonwealth and the issuing authority of fifty cents per subscriber served, or not less than $250.

The cable law provides that any person may file a written complaint regarding the operation of a CATV system with the CATV Commission or the issuing authority, and that the system operator must report back to the city and state on the manner in which the complaints have been met.

A franchise may be revoked by either the issuing authority or the CATV Commission (after a hearing) for any of the following reasons:

- False or misleading statements in any of the required information;
- Failure to maintain the required bond or insurance;
- Violation of the equal time provisions;
- Repeated technical violations;
- Assignment without the required consent;
- Repeated failure by the franchisee to fulfill the obligations or terms of the franchise (license);
- Failure to construct the system on time.

The CATV Commission and the Massachusetts Consumers' Council have the right to institute, or to intervene as parties in any court actions seeking mandamus, injunctive or other relief to compel compliance with the cable statute or the regulations adopted under it, or to prevent any illegal or unauthorized conduct.

The law allows an issuing authority to renew any license for an additional period not in excess of ten years.

An aggrieved franchise applicant may appeal to the CATV Commission which then must hold a hearing after serving notice on all interested parties. The Commission is empowered to reverse the issuing authority (although it can not actually issue a franchise).

With ten percent of the subscriber-taxpayers in a servi
area, or the State Consumers' Council, or on its own initiat
the Commission may investigate a license award or renewal, o
conduct of business under the license. After a hearing, the
Commission may modify, suspend, revoke or cancel a license f
cause. But, again, the Commission cannot grant a franchise,
the issuing authority is under no obligation to franchise a
system.

The Massachusetts Cable Commission is to study the neces
and desirability of regulating cable subscription rates until
November of 1974. Thereafter it may, on its own motion or on
of an issuing authority or franchisee, hold hearings and set
reasonable subscription rates.

The Commission is given broad discretion to establish a
making process, compel information disclosure, and enforce ra
which are to be set individually for each city or town.

The Suffolk Superior Court is given jurisdiction to hear
appeals by aggrieved parties on rate setting matters, and jur
tion, after a summary hearing, to enforce lawful orders of th
Commission.

The Commission is given authority to mediate between citi
and towns, and may decide, after hearing, issues of conflictin
exercise of jurisdiction over CATV systems. The Commission is
to represent the interests of the citizens of the Commonwealth
before the Federal Communications Commission.

The CATV Commission may visit CATV facilities to inspect
compliance with its rules or orders, and may subpoena any pers
or records to appear before them.

Any city or town may construct, purchase and operate a CA
system and such operation is subject to the cable law as if it
privately owned and operated.

On March 21, 1973, the State Cable Commission's Procedura
Regulations for Granting Community Antenna Television licenses
became effective, ending a six-month moritorium on the grantin
franchises.

The Procedural Regulations stipulate that the franchising process can be initiated by:

A) a determination of the issuing authority;

B) the filing of a completed application (a fee) by a potential licensee, or

C) a petition signed by 500 registered voters who reside in the City.

Prior to a decision on any initiative the issuing authority must hold hearings to consider the desirability of undertaking the licensing process.

Within sixty days of any initiative, the issuing authority must decide whether the licensing process shall be undertaken. If the issuing authority decides not to undertake the licensing process, it shall render with its decision, a written, public report specifying why not. Such decision is considered a denial of any application(s). License applicants aggrieved by such a decision may appeal to the cable commission.

If the issuing authority decides to initiate the licensing process, it shall establish a cable advisory committee and solicit applications for a cable license or licenses specifying a filing deadline.

Following its decision to initiate the licensing process, the issuing authority shall approve or disapprove applications within eighteen months from the date of its decision.

The Cable Advisory Committee is to be appointed by the Mayor and its membership is to reflect adequately the social, political, educational, cultural, and economic makeup of the community. Insofar as practical, the committee shall contain at least one member knowledgeable in the field of telecommunications.

The functions of the committee shall include:

A) Informing and educating the public regarding cable communications to insure maximum public participation in the licensing process and;

B) Preparing a general assessment of the cable needs the community and;

C) Preparing written policy recommendations on impor cable issues.

The Cable Advisory Committee is to prepare a report no its policy recommendations on each of the following cable is

A) Area or areas to be served;
B) Types and patterns of ownership and operation;
C) Duration of the license;
D) Construction schedule including start and completi dates, rate of construction, etc;
E) Capability of the distribution system;
F) Plan for local origination capability;
G) Criteria to be employed in assessing the qualifica of applicants;
H) Plan for minicipal cooperation with prospective li
I) Coordination with contiguous issuing authorities;
J) Plan for local supervision of the cable operator, complaint and compliance procedures;
K) Plan for institution of equal employment opportuni practices;
L) Customer contracts, rules, regulations, and charge
M) Access channels and terminal equipment;
N) Rights of privacy; and
O) Rights to information.

In the preparation of its report, the committee must ena participation by residents and other interested parties wishi to present information or suggestions for incorporation in it

The issuing authority is to hold public hearings on the report, permitting full opportunity for all parties to be hea

Following the hearings, the issuing authority must rende report taking into account the report of the committee, any a thereto, and testimony elicited during public hearings. The i authority report shall include policy guidelines with respect each of the items noted above.

Within seven days following the rendering of its report, the issuing authority must forward a copy of its report to each applicant and invite amendments and revisions to applications previously filed. The issuing authority must also solicit additional applications and set a simultaneous filing deadline for the receipt of responses and new applications.

The State Cable Commission's Procedural Regulations stipulate that within a reasonable time following the filing deadline for applicant responses and new applications, the issuing authority must again hold public hearings to assess the qualifications of each applicant. After these hearings the issuing authority must simultaneously approve or disapprove each applicant. License applications aggrieved by a denial by the issuing authority may appeal to the Cable Commission. Concurrent with approval, the issuing authority is to grant a provisional license to each approved applicant, and issue a written public statement of the basis of its decision.

A final license to construct and operate a cable system is to be granted by the issuing authority following substantial compliance by a provisional licensee with each of a number of technical, legal, and financial requirements.

However, in the event the issuing authority finds that there has been a failure to comply, the issuing authority must issue a written statement setting forth in detail the basis of the finding, and, simultaneously, send a copy of this statement to the provisional licensee(s) and the cable commission.

The Massachusetts Cable Commission also issued on March 21, 1973, a comprehensive set of required application forms for potential cable licensees, standardized balance sheet forms, and complaint record forms.

APPENDIX E

WHAT BELONGS ON THE CABLE

John E. Ward

Presented in the Panel Session

"Blue Sky to Cash Flow"

21st Annual Convention
National Cable Television Association, Inc.
The Conrad Hilton Hotel
Chicago, Illinois

May 15, 1972

Electronic Systems Laboratory
Massachusetts Institute of Technology
Cambridge, Massachusetts 02139

WHAT BELONGS ON THE CABLE

John E. Ward*

Many papers and articles over the past two or three years have uggested that the 300-MHz coaxial CATV cable carries sufficient bandwidth nto(and out of) the home that it can serve almost every conceivable home ommunications need--providing as many TV viewing channels as anyone can hink of a use for; two-way data, audio, and data services, and perhaps ventually taking over the functions of the present voice telephone system nd augmenting it to provide full nationwide videophone service with TV andwidth. At the same time, the cable is touted as the way to also provide ata and facsimile services between businesses, video and audio inter- onnections between schools (and school systems), and a wide variety of unicipal communications services such as police and fire networks, traffic urveillance and control, and so forth. The purpose of this paper is to xamine some of the realities of this communications utopia from the tandpoints of performance and cost, suggest those areas where the cable eems best suited to providing new or improved communication functions, nd just as important, point out those areas where the urge to "cable-ize" ay be inappropriate.

First of all, let's talk about cable capacity. It is true that he 300-MHz bandwidth of a single coaxial cable, or the 600-MHz bandwidth f two cables, can theoretically carry about as many entertainment, educa- ion, or citizen-information viewing channels into the home as anyone would probably ever want. As is well known, there are a number of complicated echnical problems in trying to use every scrap of the available cable andwidth, but these do seem to not represent a serious limitation at present, and should gradually be solved in the future as cable technology improves. The present cost increment for just increasing downstream capacity per cable to 25-30 channels is not great, but cable system costs (including frequency multiplex/demultiplex equipment) can rise quite steeply if many additional signals of various types are to be carried;

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*Deputy Director, Electronic Systems Lab., M.I.T.

i.e., the solution to the technical problems of adding these signals without mutual interference may be quite expensive in terms of system c

It is also true that through use of presently available time-division-multiplex (TDM) techniques, just a few channels used for two-w digital data services, plus possibly addressed-frame video (sometimes ca "frame grabbing), can provide individualized communications services of enormous capacity for all subscribers in a system. A single one-megabit two-way data channel (which requires no more than 4 MHz downstream and 4 MHz upstream) can,for example, drive about 4,000 printers simultaneous at 10 characters per second, at the same time accepting the same simultaneous input rate from 4,000 keyboards or other data input devices. Since every home obviously won't be receiving or sending all the time at this rate, such a data channel should easily serve 20,000-30,000 homes (or mor depending on how much access delay is permissible), each of which can als be polled at least every few seconds to see if they wish to initiate communications. If in addition, just one downstream TV channel is devote to addressed-frame video, as many as 216,000 different text or picture frames per hour can also be transmitted, surely sufficient for the on-demand information access needs of our 20,000-30,000 homes.* These individualized services, however, do carry a high incremental capital cost for the necessary home terminal equipment. Added head-end equipment costs are nominal on a per-subscriber basis, except as the services become more sophisticated. More will be said about this later.

Where the seemingly bountiful cable capacity begins to look less bountiful is when one adds requirements for any significant number of non-TDM, dedicated, upstream or downstream TV-bandwidth channels that are for "private" use of some sort, and not for general viewing. For example, 4-15 TV channels per trunk seems a reasonable range of upstream capacity, depending upon whether one has a one- or two-cable system (this assumes tha in a two-cable system about half of one cable would be used for upstream

*See for example "The Reston, Virginia, Test of the Mitre Corporation's Interactive Television System, John Volk, Report MTP-352, Mitre Corp., May, 1971. This system digitally addresses each interlace field separately and thus transmits 60 262-line images per second, each containing up to 800 alphanumeric characters.

signals). Allowing a few of these upstream channels for remote program origination use, a few each for school and municipal TV interconnections (note that these interconnections would probably be two-way and thus also need a downstream channel per upstream channel), there isn't room left for very many traffic or security surveillance camera channels (for example), or for much private TV channel usage by individual subscribers.

Carrying this last point to the extreme, the total upstream and downstream channel capacity of a tree-structured cable system is clearly insufficient to support large numbers of simultaneous, individual, two-way video conversations (i.e., videophone service). For that, a switched hub-structured cable plant (with individual subscriber lines) would be needed, organized like the telephone system. This is the cable configuration of the Rediffusion, Inc., "Dial-a-Program" CATV system,* and may certainly be cited as a potentially great advantage of that system. However, their present one-of-36 program-distribution switchgear was not designed for line-to-line switching and would have to be very greatly reorganized and augmented in order to provide the switching functions needed for many simultaneous subscriber-to-subscriber two-way connections on a dial-up basis. The cost of such switchgear would be very substantial.

Returning to the tree-structured cable, it is interesting to speculate what would have happened if cable systems of this type had been invented 100 years ago and installed before any other type of communication system. I am sure that the bottleneck represented by the finite simultaneous cable channel capacity per trunk would eventually have forced many full-time users (or potential users) off the cable and onto circuits dedicated for their own use, and many other users desiring part-time, private circuits onto a switched network of some sort. Thus, one must certainly closely examine potential "non-broadcast" cable communications functions or services that cannot be time-division multiplexed on just a few channels (in the manner discussed earlier) to see if it is technically

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*"Dial-a-Program--an HF Remote-Selection Cable Television System", R.P. Gabriel, Proceedings of the IEEE, July, 1970, pp. 1016-1023.

practical (or economic) to devote the necessary cable bandwidth continuou to their needs, as opposed to services available to all subscribers. In many cases, dedicated facilities may represent a better solution for user with heavy communication needs between just a few locations--for example, if closed-circuit, inter-classroom usage between all schools in a city requires more than one full-time two-way channel, a private inter-school cable may be advisable, in addition to CATV cable tie-ins for its programm and general communication services. Of course, if a given cable system do have unused operable channels, adding such functions or services up to capacity makes sense, at least for the short-term. The intent of this discourse is not to say that such services don't belong on the cable, but to point out that there are limitations in total capacity, and that the various "closed-circuit" services that one hears discussed can't all be handled without going to special cable configurations for this purpose. The question then arises as to whether these special, dedicated cable facilities should be handled by a CATV operator, or in some cases, even be interconnected with a CATV system at all.

On the other hand, it is worth re-emphasizing that the cable does have a unique, very practical capability for providing, at little cost in bandwidth, a class of communications services that can only be awkwardly handled (if at all) by existing communication systems--the simultaneous, rapid, two-way interaction between a very large number of individual subscribers and a central information processor/source. The key concept here is that the network configuration of a cable system permits the placing of all subscribers on one or more gigantic, broadband party lines on which addressed, time-division-multiplex, messages can be transmitted at very high rates. This clearly represents a new dimension in communications capability, and one which has great potential as an addition to other cable services. The main problem is: What sorts of services can be made to pay for themselves, given the high costs of the necessary terminal equipment for home and possibly business uses (and for certain services, of the associated head-end equipment and/or interconnections with other data bank systems)?

I am afraid that I have no ready answer to this question, but it may be of value to cite the factors which must be considered. First of all, I see this as a "chicken or the egg" situation. The economics of two-way communication has a serious critical mass problem, both in the number of subscribers equipped and connected for a given polling-type service (say meter reading), and also in the number of access services (banking, shopping, etc.) available to a given subscriber. (As an AT&T official was recently quoted in relation to the decision to temporarily shelve Picturephone, "It's no good if there is no one else to talk to.")* Thus two-way hook-ups and services may have to be subsidized in some way to ever get off the ground and their eventual self-supporting viability would seem to depend on the totality of a large number of different services each with modest fees, rather than a few services with high fees (a possible exception is pay TV).

Second, there is still a large human factors question in regard to the sorts of services under discussion, which are generally new services never before available. Given that a broad spectrum of possible services is set up and offered to subscribers in their "electronic fortresses", will they use them to the extent necessary for economic viability of the services? For example, even if a service such as home shopping is immensely popular as a concept, would enough subscribers pay a monthly terminal fee for the service, plus possibly a price premium on purchases due to the added sales costs for goods presentation on camera, automated order taking, and home delivery after purchase? Large-scale experiments, conducted for a substantial period of time (sufficient for novelty transients to die out), seem the only way to really shed some light on these difficult questions, and will require extensive cooperation and commitment on the part of many organizations for a given experiment.

A brief word about head-end costs for new types of individualized services. Simple polling and data store-and-forward interconnections with

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*"Picturephones Shelved Due to Lack of Demand", The Washington Post, April 13, 1972.

other computerized data services (banks, stores, reservation systems, et can be handled by a small computer with a capital cost of only a few ten of dollars per subscriber. Similarly, the head-end could forward subscr requests for addressed-frame video signals originating elsewhere (say in library) and put the signals on the cable at little cost in head-end equ However, if the cable operator wishes to provide digital data bank, data processing, or video frame services himself, his head-end costs could go by an order of magnitude or more, depending on the services provided (rap access memory devices of all types tend to be very expensive). Only time and experience will show how some of these services can best be provided (assuming that there is a real market for them).

This discussion has been deliberately couched in rather general terms, without attempting to predict costs for this and that out to the penny for some future period. Many such predictions are available, and the author has previously made some of his own.* What seemed more valuabl for the present purposes was an exposition, from a communications systems viewpoint, of what types of services the cable seems best at, and of what other services it could provide, but with performance difficulties or at high cost. It is hoped that this has proved useful.

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*Appendix A, "On the Cable--The Television of Abundance", Sloan Commission on Cable Communication, McGraw-Hill Book Co., December, 1971.

Appendix F

Minutes of the Boston Consumers' Council Cable Television Hearings

OCTOBER 3, 1972
OCTOBER 5, 1972
OCTOBER 10, 1972
OCTOBER 11, 1972

(INCLUDING SUBMITTED STATEMENTS)

BOSTON CONSUMERS' COUNCIL

CABLE TELEVISION HEARINGS

Mrs. Maureen Schaffner, Chairman of the Consumers' Council, opened each of the hearings with the following introductory remarks:

"Welcome. Under the provisions of the Federal Communications Commission's cable television regulations and the recently enacted Massachusetts Cable Television Law, the City is empowered to license a cable television system.

The Mayor has assigned the initial planning for cable television to the Consumers' Council.

The Council views these hearings as an opportunity for all interested residents to air their views on cable television, before decisions on franchising are made.

We've posted some information pertinent to the conduct of these hearings, including several topics which we hope will be discussed: such as ownership, control, programming, rates, and regulations.

I'd like now to introduce the members of the Consumers' Council."

Following the introductions, the hearings were opened up to the public.

October 3, 1972

3 P.M.

W. Bowman Cutter, Director of the Cable Television Information Center in Washington, D.C., said that "Cities and their people rarely anticipate or make sensible policy about developments that can influence change. Cities and their people don't understand how quickly change occurs, and they don't understand the significance of change."

Cutter noted that many questions about cable are unanswered. The use to which cable will be put is in considerable doubt: will it be used in a valuable public way? Cutter said the FCC has promulgated rules that let cable into the cities and recognize it as a media in its own right; but it still is not understood. We know cable has the potential to do more than merely bring a better reception to home television sets, but we're uncertain as to what direction it will take and its future value is unclear.

Cutter pointed out that the judgements we make now can affect the way in which cable systems will work in the future. He outlined several areas with which cities and towns should concern themselves:

1. Process - the City must decide what it wants. In the past, most communities have simply waited until proposals from entrepreneurs came in and then decided vetween them. CATV is too important to just wait to see what you get. The community must decide what it wants, ask for it, and see whether or not the entrepreneurs can give it to them. It's too important a decision, Cutter points out, to be made without significant community involvement and without it being in the open.

2. Design - the key issues of design are:
   a) capacity - how big will the system be? How many signals will it carry?
   b) localness - what areas of the City will the system serve?
   c) origination possibilities
   d) interconnection possibilities - within the City, areas around it, and areas far off from the City.

3. Uses - public institutions and community groups shoul
now to look realistically at how the system will be u

Mr. Cutter pointed out that Boston should work towards a situation in which who owns the system becomes irrelevant. He suggests that if the system is well planned, properly designe it does not matter who operates it.

The next speaker was Mr. Jack Bernstein of the Committee Community Access:

Mr. Bernstein stated that the first programs that really communicated to him were WCVB's coverage of the Democratic and Republican Conventions. Bernstein said he believed this covera was programmed by a group called "Video Cooperative", comprise of "video freaks," whose programming reflects not a concern for pr but a love of the media. Mr. Bernstein expressed his strong fe that groups like this deserve a channel of their own.

Miss Irene Burns (South Cove) rose to ask a question. She asked, "Why is the Council here today?"

Mrs. Schaffner responded that the Council had called the hearings to give the public an opportunity to voice their conce on cable and to incorporate the public's expression into a repo to be given the Mayor White.

Miss Burns then asked if any litigation were going on at the State or municipal level at this time.

Mr. Borten answered that he knew of no litigation at the State level regarding cable television, and reported further tha no litigation at the City level was taking place at this time.

Mr. Sam Sawtelle of the Dorchester United Neighborhood Association spoke next:

He asked if cable television would become another public ut He expressed his concern that consumers would wind up paying for the programs they now receive on free television. He asked if th $20.00 installation charge and other fees would just be new char imposed on the general public.

The next speaker was Paul Crayton from the Allston-Brighton APAC.

Mr. Crayton expressed his concern that cable is a technical and new issue of which people are not yet aware. He suggested th the City and the Consumers' Council conduct, or rather undertake an educational effort, perhaps using the Little City Halls.

Mrs. Schaffner asked if the educational program that Mr. Crayton mentioned should, to his thinking, be conducted by the Consumers' Council.

Mr. Crayton said that he felt it should.

The next speaker was Mr. Tony Pharr, of the Cable Antenna Television Information Service (CATVIS):

Mr. Pharr asked if the hearings being conducted at this time by the Consumers' Council were, in fact, those hearings required by State Law prior to the franchising of a cable system, and if they pre-empted the State regulations.

Mr. Borten answered that these hearings were not the hearings required prior to franchising. He expalined further that the hearings were entirely preliminary to the franchising process and that if the City should move ahead on cable development, further hearings would definitely take place.

The next speaker was Mr. Tomas Rivera (CATVIS):

Mr. Rivera stated that the Consumers' Council hearings were premature. He explained that his organization, CATVIS, had made a request to Richard Borten that the City of Boston undertake a comprehensive survey to determine the programatical, information, and service needs of the community. Mr. Rivera said that Mr. Borten's response was that the City did not have the money to undertake the survey.

Mr. Rivera said that the City wanted input from the public but that the public and the decision makers are not yet aware of the economic and programming potential of cable. "If", Mr. Rivera said, "the City of Boston can do a parking survey, then it can implement a survey to determine the City's CATV needs."

Mr. Rivera made a formal recommendation that the City of Boston do a comprehensive survey of those needs and he further recommended that CATVIS, his organization, do the study. He said the study would cost $42,000, much of which would go to the University of Massachusetts for hiring people to conduct the survey.

Finally, Mr. Rivera said that the public should be asking the Consumers' Council questions, "instead of the Council trying to find out what everyone already knows".

Mrs. Strauss stated that the purpose of the Consumers' Council was to try to find out what the public wants. She asked Rivera how comprehensive his survey was.(Rivera answered that his survey encompassed the entire City of Boston; that 600 people would be interviewed.)

Mrs. Strauss asked if the CATVIS survey would educate the public.(Rivera said that it would by interfacing the use of video tape with the actual questions contained in the survey.)

The next speaker was Gloria Gibson, a graduate student at Boston University, who stated that the community is not aware of CATV or of its potential. "Someone," she said, "needs to inform the community before it can come before the Consumers' Council and present its additives."

The next speaker was Skip Finley who identified himself as a radio station employee: Mr. Finley said that there are now f channels available and that six should be reserved for the Bla community. Finley urged that there be a review board to ensure continued excellence of cable television.

The next comments came from an unidentified speaker in the audience: He said there was no commercial station willing to program jazz music at this time. He urged such programming and said that Black management of 25% of the available channels mig help.

The next speaker was Mr. Charles Grigsby, President of Rox Cablevision Co:

Mr. Grigsby said that he hoped the results of the cab hearings would be published and made public. He urged that the format of a Request for Proposals document also be made public and that public hearings be held on the document before bidders were solicited. He said deadlines should be established for pro sals and time should be allotted after proposals came in f amendments. Specific dates should be set for hearings and speci dates for the granting of a franchise. In general, Mr. Grigsby urged that the entire process for the granting of a CATV franch be an open one.

October 5, 1972

7 P.M.

Mrs. Schaffner opened the hearing at 7:15 P.M. She delivered a statement expressing the purpose and intent of the Consumers' Council hearings. Mrs. Schaffner further explained that the Council had met since the last hearings. She asked Mr. Borten to speak on the issue of cable television as it relates to the City of Boston.

Mr. Borten said that the Council hoped to make some effort to explain where the City of Boston is on cable and the role of the Consumers' Council in the franchising process. He explained first that absolutely no decisions on the issue of CATV have been made by the City as yet. Borten indicated that several companies had expressed interest in obtaining cable franchises in Boston. Those CATV companies are : West Essex Cable Television Company of Newark, New Jersey; Viacom Communications Company of New York; Roxbury Cablevision Company of Boston; The East Boston Community Development Corporation; TelePrompTer Cable Television of New York; Charles River Cable Television Inc. of Waltham; ComCast Company of Pennsylvania; The First Communications Company of Bethesda, Maryland; Colonial Cablevision of Woburn, Massachusetts. Each of the firms that wrote, Borten said, had received responses from the City indicating that Boston is not yet considering proposals.

Borten indicated that the City administration felt that Boston was without authority to grant a franchise until after the enactment of the State Cable Television Law in November of 1971. In February of 1972, Mayor White asked the Boston Consumers' Council to study the issue of cable television. The Consumers' Council pulled together a team of city employees who were interested in the issue of cable television and began to work on cable part time. The City staff read all that they could find on CATV, met with any interested parties and sought information from faculty members at MIT. Borten said that the City team felt that CATV is now in a generation gap. CATV systems which had primarily been developed in rural areas, cut off from television signals, were now beginning to develop in urban centers. The technology, which has reamined basically the same since the earliest days of cable in the 1940's, is suddenly undergoing drastic changes. Microwaves, laser beams, even fibre optics are being considered as possible technological links in a cable system. Borten said the municipal people with whom he had been working, were concerned with the question of whether or not Boston should consider CATV development until its technological and developmental generation gap closes. The City does not want to see the community build up expectations of what cable can provide when those expectations cannot be fulfilled for ten or more years. Boston wanted to know what it could realistically expect from a cable system built now. What could Boston consumers expect for their $5-7.00 per month in subscription fees? The City wanted to know how its own departments could use cable to serve Boston citizens. The cable team working for the Consumers' Council developed a primer on cable during the

summer which was directed to City department heads and aimed stimulating their thinking on how they could use a CATV syste Many departments, including the Health and Hospitals Departme the Library Department, Fire Department, Commission on the El Human Rights Office, and others have already expressed a keen interest in CATV's ability to achieve their objectives.

In recent weeks the City staff has begun to study the question of rate regulations, both for consumers who would be subscribers to a cable system and charges for those who would be using the cable systems channels.

The Consumers' Council, Borten said, views its job as the protection of the City's consumers. Usually, the Council gets involved after a problem has arisen; after a consumer has been gypped. This time, the Council hoped to have a better chance. hoped to protect consumers from potential abuses before a new public utility was developed. The Consumers Council had hoped the hearings would evoke some community response on several qu which it feels are vital. Among them are: a) ownership; b) acc c) enforcement of the City's regulations on cable; d) the mana ment of the scarce resources that cable needs - underground du space, for example; e) expansion and growth of cable after the system is built; f) financing public access and municipal use CATV.

The next speaker was David Smith of Roxbury:
Smith explained that he had been working under a Ford Foun Grant on the issue of CATV. He said, too, that he was associate with a potential operator for a CATV system, Roxbury Cablevisi Company. He raised three areas of concern that he felt hadn't y been discussed at the hearings.

A. Who owns the system? Who has access to the system? Who makes money on the system? He suggested the Consumers' Council consider the use of municipal bonds so that the City could develop its own system.

B. Accountability. Presently, Smith said, the cable compan accountability is to the company's stockholders. He fel that no large company was going to be accountable to Boston's consumers. Smith said, there were two protecti mechanisms that Boston consumers should insist on:

1. that Boston people own the cable system
2. that more than one system be developed in the City o Boston; each system accountable to its constituency.

C. How does the City maximize its use of cable? Smith indic that the question is best answered by municipal ownersh

Mr. Borten asked how many channels Smith thought Boston should provide for its own use. Smith said that was a difficult question to answer; but that the City should not put itself in a position where ten years from now it would have to fight to get back channels for public use. Hardware should be owned and pa

for by the City of Boston, and neighborhood groups should have franchises to run the cable system, renewable on a 3-5 year basis. All the profit should go to perhaps five viable franchisees.

Mrs. Schaffner asked how can the City divide Boston into equally viable neighborhood franchise areas? Again, Smith said, this was a difficult question to answer. Neighborhoods are mobile; different people have different concepts of neighborhoods. But to give a franchise to a huge outside company was not the answer. East Boston, Smith felt, would probably not be a viable area by itself. Perhaps it would be if it were joined with another neighborhood.

Mrs. Schaffner urged that people from the audience address themselves to the question of cable programming.

Tomas Rivera was the next speaker: Mr. Rivera expressed agreement with Mr. Smith on the issue of local ownership. Mr. Rivera recommended that the management and ownership of a system be integrated. He felt that if owners were from Boston they would be more responsive to the needs of the City. Rivera pointed out that there was a trend in the cable industry towards system ownership by very large nationwide companies. He expressed a desire that ownership in Boston be totally local. Mr. Rivera said that in consumer programming, Boston should take into consideration "the bi-lingual, bi-cultural, and the bi-cognative needs of the community." He urged at least one channel for the Spanish speaking community and the same sort of arrangement for the other ethnic communities of Boston.

Miss Burns from South Cove asked Mr. Rivera if he was advocating ownership of cable systems in Boston by the people. (Mr. Rivera said that he was.) Miss Burns then asked if Mr. Rivera knew of anything owned by the people from which they profit. (Mr. Rivera said he did not.)

The next speaker was Paul Crayton of the Allston-Brighton APAC: Mr. Crayton asked what had happened at the Consumers' Council meeting which took place between the Tuesday hearing and the current Consumers' Council hearing. Were any plans made for educating citizens with regard to CATV?

Mrs. Schaffner said that there had been extensive discussion of the need to educate the community on CATV, but that no decisions had been made on whether the Consumers' Council should conduct an educational effort or just how an educational program should be done.

Mr. Crayton expressed his feeling that the Little City Halls should be used to educate citizens on CATV.

Mrs. Strauss asked how many groups were represented at the hearings, and stated that many community groups had been notified, but were they here?

Mr. Crayton replied that few, if any, groups were present but he said, too, that if the hearings were brought into the community, held in various neighborhoods of the City, the resp would be much greater.

Mr. Charles Grigsby, President of Roxbury Cablevision was next speaker:

He said that one of his major concerns is that of procedu The document that requests proposals for the development of a CATV system is an important one, and there should be a hearing on that document before it is issued. The time frame for the submission of applications is a particularly important factor the request for proposals document. The big companies, some of have applied for franchises in Boston, have already prepared request for proposals documents and could probably file them i very short time; but many smaller companies, including some th are Boston-based, would need a much longer time period to prep a proposal. Mr. Grigsby pointed out that diversification of ow ship should be a primary criterion used by the City in evaluat applicants. Other important criteria, he said, were:

1. the amount of time owners are willing to put in managi a franchise;
2. the kind of proposals for programming that are made an the options for municipal use of the cable system;
3. the innovations that are proposed by the applicant;
4. does the applicant propose only 'toke' local ownership
5. the degree to which the applicant will provide jobs fo Boston residents;
6. the degree of participation that minority groups in th City will have in the cable system;

Mr. Borten asked Mr. Grigsby if he favored dividing Boston into a number of franchise areas or having one city-wide franc

Mr. Grigsby suggested that Boston have one or two franchis at the most, with heavy citizen participation in ownership for most effective system. Grigsby said that he did not see a sepa between the ownership of cable programming, cable equipment, a other elements of the system.

Mr. Borten asked if Grigsby favored owner participation i cable programming.

Mr. Grigsby answered by saying that he saw a combination o a large operator and a local operator owning a system; that it be very difficult to have input in programming if there were o a large operator owning CATV in Boston and perhaps having his in Chicago. He said he favored the owner making available a ma use of available channels to local groups. Grigsby indicated t owner of a CATV system should be willing to put some capital i programming.

Mr. Fennell asked if Mr. Grigsby were suggesting that the capital come from large, outside companies. Mr. Grigsby said no, that the capital should be coming from Boston; the expertise for cable development should come from the outside companies.

The next speaker was John Meyers. Dr. Meyers said that in granting a franchise, the City would be creating a monopoly. He said that it was not clear what this monopoly should do, and what restrictions should be imposed on that monopoly.

He said that one way to view a cable system was as a money making entity—as an entity designed to provide the consumer with a particular service. He said that even if the system operator were to be a Boston based group and relatively unregulated, it would not necessarily ensure service in the public interest, or programming in that interest. To expect it, one would need a lot of confidence in the owner. It had been pointed out, Meyers said, that we may face national network programming, and Dr. Meyers agreed that this is likely. Because of the economy of scale, it would be attractive even for a local owner to make use of these programs. It may be what the citizens of Boston want.

Dr. Meyers said that if there are a multitude of channels, it may be reasonable to use these channels city-wide, rather than having only neighborhood oriented programming. He said, too, that the economics of cable demand attention. In the first five or ten years, the profit margin of a cable system is slim but it will increase in time so that in fifteen or twenty years the profits will be substantial. The City could preclude large profits by insisting that more channels be produced as time goes on, guaranteeing anyone interested in programming a variety of channels to use. We could create, or should create, as many channels as economically feasible.

In response to questions from the floor, Dr. Meyers said that we could expect twenty channels immediately if a cable system were developed in Boston. He pointed out that we need as many channels as people want to use. Several may be empty for a few years, but in time, the need for channel capacity will grow.

He pointed out that rates would be higher if two cable franchises were developed in the same area. There just wouldn't be enough space in the underground conduits for competing cables to be laid, and the consumer would pay more since each system would serve relatively fewer subscribers.

In response to a question from the floor as to what choi a dissatisfied consumer would have in a monopoly, Dr. Meyers pointed out that there would be an abundance of channels to c from. If none were satisfactory, one could file a complaint c your subscription.

Mr. David Smith, Roxbury Cablevision, spoke in response Dr. Meyers presentation. He said that cable has enormous tran mitting capacity and we must produce a system that has provis for medical care and other public uses as well as coverage, f example, of a North End Italian Festival. Cable might provide cultural presentations. A primary issue to consider is how ca will design itself to meet the needs of the City.

Madeline Burns, South Cove Project, spoke next:
She brought to the Council's attention a 1964 magazine ar showing a proposed building for the Park Square area, pointing out that a rendering of that building showed a large antenna. suspected, she said, that it was a large CATV tower, and that decisions on franchising and policy had already been made. She voiced her concern that the hearings were a mere sham for the public, designed to make people think that they had a voice in planning of a cable system, when in fact, the decisions had be made at least 10 years ago.

The meeting was adjourned at 8:47 p.m.

October 10, 1972

3 P.M.

Mrs. Schaffner opened the meeting and called on Mr. Borten, Executive Director of the Council, to review some of what had been discussed at the two previous meetings. Mr. Borten noted that the hearings were being recorded by the Consumers' Council and by several private groups. He said that copies of the Consumers' Council recordings could be obtained by calling the Council's offices at City Hall. Anyone wishing to have a copy would have to provide their own tapes and make transcriptions.

The first speaker was Jim Loving, Manager of the Franklin Field Little City Hall in Mattapan: Mr. Loving said that the community in which he was working is concerned both with ownership and programming. He felt that it is very important to allow for the proper kind of local community programming. He urged that the Consumers' Council note these needs and ensure that they are met.

Mrs. Strauss asked Mr. Loving what he envisioned as satisfactory programming for his community. Mr. Loving replied that that could perhaps be determined by holding community meetings aimed at determining what the people want.

The next speaker was Leonard Morrison from Northeastern University: He said that Northeastern University was most interested in seeing the development of a cable television system in Boston. He urged that there be maximum use of cable for instructional purposes. In answer to questions from the Council, Mr. Morrison said that Northeastern was in a position to do programming for a cable system. He answered further questions on the sort of programming that Northeastern University could come up with by saying that the Office of Educational Resources believes cultural instruction could be incorporated in a home classroom through lectures and other programs. He said Northeastern was already producing materials for television and would hope to provide programming, or work in conjunction with a franchisee in developing educational programs. A person in the audience commented that Northeastern University should not instruct citizens in Boston but should fill their needs. Mr. Morrison said that the idea of the Universities in the Greater Boston area serving as a clearinghouse for educational programming had been discussed and that this kind of consortium approach might mean that only one or two channels would be needed for the kind of programming Northeastern had in mind.

Tomas Rivera of CATVIS responded to Mr. Loving's previous statement by saying the community should be in a position to demand the kind of programming it wants from the cable operator. In response to comments by Mr. Morrison of Northeastern University, Rivera said that he resented Northeastern University presenting itself as an institution to help the community. Rivera said "the community should be helping the University."

The next speaker was Mr. Gerald Bush, Director of the Economic Development and Industrial Commission for the City of Boston:

"In an examination of the potential of Cable Television to serve as a resource for economic development, the staff of the Boston Commerce and Manpower agency has concluded that the establishment of a CATV system in Boston may have positive economic ramifications upon Boston's economy in the following manners:

1. In the creation of new Boston-based employment opportunities.
2. An improvement in community economic development through the establishment of a totally new investment opportunity.
3. A further enhancement of the attractiveness of Boston to industry and commerce by substantially upgrading the quality of the City's communications facilities.

"Though CATV is an extremely capital intensive industry, the day to day operations of a large CATV system will create numerous job opportunities in the areas of:

1. CATV operations management - both line and staff functio
2. Maintenance and repairs of CATV hardware
3. Sales - both advertising time and subscriptions.
4. Programming technicians - e.g., camera men, etc.

Gerald Bush (cont'd)

"Other job opportunities will be created in areas indirectly related to the actual system, the most important of these areas being the production CATV software.

"The large number of CATV systems that will be established during the next decade, throughout the country, will create a huge demand for CATV software. The Boston area has all the essentials necessary to become a major center in the production of CATV software.

"Two of the prime categories of software that will be in demand are educational and medical information programs. The Boston area is renowned for its prominence in both of these fields, and hopefully this expertise can be channeled in such a way that Boston will become a national leader in the area of CATV software production.

"CATV presents a tremendous investment opportunity to those parties that are interested in community economic development and minority owned enterprises. A CATV franchise has all of the ingredients necessary for a successful community investment venture; it is relatively new, thus no established competition; it is inherently related to the residents of the city; it has great potential for being economically viable and it is of social relevance.

"EDIC's staff believes that on the issue of franchise ownership there should be as much community equity as possible. We feel that the optimum form of ownership will be a coalition venture that will include those parties which represent the interests of the city wide community, with special emphasis on minority participation; and those parties which can offer substantial financing and managerial expertise.

Gerald Bush (cont'd.)

"We feel very strongly that the conomic leverage obtained f a viable CATV system should be used to promote community economi development in areas outside of CATV. The cash flow generated b a mature CATV system within a large urban city may exceed $500,0 per month and we feel that this money must be used as leverage t obtain financing for other business enterprises aimed at communi development.

"CATV has the tremendous potential to make Boston more attra to industry and commerce. To grasp the ramifications of this st ment, one must realize that Boston, like most large cities, is basically an information and service center for the surrounding a At the hub of providing such services at the local, suburban, st regional and national level are the communication facilities of the city.

"The future of Boston's economy lies in its potential to efficiently store and transmit data for its various economic components. Though my department hopes it can slow the pace, pre sent trends indicate that Boston's economy is going to be based upon services, and the level of services is directly related to the sophistication of the communications facilities available. If Boston is to continue to serve as the headquarters of the New England Region, then it must have the communications facilities capable of attracting not merely the branch offices of insurance, stock brokerage and banking firms, but rahter their regional operations.

"EDIC is presently developing a strategy to exploit this potential of CATV and other types of wired communication in

Gerald Bush (cont'd)

attracting new commercial enterprises to the City. As part of this strategy we advocate that the City install the most flexible type of CATV system possible, so that it can easily adopt to any new technoligical changes in the near future, and that the entire system be managed under one franchise for an initial period of time.

" We advocate a single franchise system for the following reasons:

1. the management structure between the City and the franchise will be more efficient during the initial period;
2. The implementation of new technology will be easier;
3. a more coordinated effort can be put forward in experimenting with the possible uses of CATV within the commercial districts (this could not be done under multiple franchises since it would be grossly unfair to give any franchisee sole ownership of the extremely lucrative commercial district);
4. most of the benefits of multiple franchises, especially in the area of ownership, can be incorporated within a single franchise agreement;
5. interconnection between regional systems will be easier under one system;

"As Director of Manpower for the City, I am also extremely interested in the potential benefits of CATV in the area of vocational training and job information. By linking all of the community manpower training centers in Boston via cable, it would

Gerald Bush (cont'd.)

be possible to less expensively utilize various audio - video training devices. Job training education could also be televise via cable to those people who are unable to attend regular train centers. This would be especially helpful in situations where mothers are "home-bound" due to parental responsibilities. Teach English to Spanish speaking people might be particularly adoptab to this method. Job training instructions could also be sent vi cable to the Deer Island Prison.

"Information about employment opportunities could also be ai on T.V. This information could be accompanied by instructions o how to fill out the job application forms and interviewing techniques. In the future EDIC will continue to study the economic ramifications of CATV upon Boston's economy and we will relay our findings to the general public."

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BOSTON REDEVELOPMENT AUTHORITY
Library

Mrs. Strauss asked if Mr. Bush and his department favored granting a franchise to an outside company. Mr. Bush replied that EDIC had not specifically addressed itself to that question, but that it did strongly favor heavy community participation in ownership.

Mrs. Schaffner asked if the benefits of a multi-franchise system could be incorporated into a single franchise. Mr. Bush said that he hoped that his agency could work with the franchisee to ensure that the cable system was such that it attracted new industries, new businesses, new jobs, and provided the kind of programming that fulfilled the community's needs.

A member of the audience asked Mr. Bush if EDIC had done an in-depth survey on cable potential. Ted Welles, a member of Mr. Bush's staff, replied for Mr. Bush that a substantial study had been done by him as a member of the team working for the Consumers' Council on CATV and that it had indicated an excellent potential for community development.

The next speaker was Richard Burns, of Charles River Partnership:

He advocated a city-owned cable system and said that any private operator who obtained a city franchise would surely become rich with it. Franchises grnated for a long time would lead to the City losing control of what a cable system would provide. He suggested that the City contract with someone to manage a cable system and urged that the telephone company be required to cooperate more than it has on most issues in the past.

Mr. Tarallo asked if Mr. Burns had any idea of what the cost of City ownership would be to Boston. Mr. Burns answered that he did not know. Mr. Tarallo said that he could see the value of a City owned system but asked how long it would take before the City would enjoy financial returns on an investment in CATV; he pointed out that City owned facilities have a way of degenerating over a period of time and expressed teh notion that perhaps a study of costs would be helpful.

Mr. McCarthy asked if Mr. Burns felt that the City would be able to find a company who would manage the system who would have the proper qualifications. Mr. Burns' reply was that there are lots of companies and individuals who know how to run a cable system. Mr. McCarthy asked if Mr. Burns knew of any other systems that are run that way. Mr. Burns replied that there were a lot of companies and individuals who are qualified to run a system; who are able to run one. He did not know of any systems that are run that way now, but he felt that it is a good idea.

Mrs. Schaffner said that she was concerned, in speaking of a City owned system of the 'big brother' concept of a city owning a communications system and eventually being accused of monitoring and controlling the City's communications. Mr. Burns suggested that Boston could create "a kind of Port Authority" entity to run cable.

Dean Huber asked how we could assure that the City's comm cations needs will be met as opposed to a city-owned system si fulfilling what has been decided by the administration to be t communication needs. Mr. Burns replied that "democracy is brea down if those needs cannot be met."

The next speaker was Jack Bernstein of the Committee for Community Access:

Mr. Bernstein pointed out that the Consumers' Council was getting the benefit of all the information that was available. suggested that if the Council is sincere in its purpose, it sh elicit a firm ccommittment by the Mayor to respond to the vari issues that need to be discussed before a franchise is issued. said that many groups in Boston have a great deal of informat which they are willing to share.

Mr. Bernstein added that there are at least four video cooperatives in the area who are devoted in their interests of use of the media and who would be willing to search out what t needs of the community are and plan the media response to thos needs.

Mr. Tomas Rivera of CATVIS spoke once again noting his fe that it was ironic that we had not yet heard from cable operat and questioning why they hadn't come forward with their expert

Mrs. Strauss replied that these hearings were primarily intended for community input and that she could understand why cable operators hadn't been anxious to speak.

October 11, 1972

7 P.M.

Mrs. Schaffner opened the meeting and introduced the members.

The first speaker was Mr. Robert Coard, Executive Director of Action for Boston Community Development (ABCD):
Coard pointed out that cable television can help poor people. It can provide jobs and job information; it can provide an awareness of community services; it can provide educational opportunities. Mr. Coard said that he feels that cable can help alleviate some of the tensions and apathy of the poorer community. It can provide small businessmen, who are numerous in Boston, with unique advertising opportunities not persently available to them, and also with a means of protection.

But whether of not the poor in Boston benefit from cable depends on a number of things; among them, the FCC, the State, and the City—and the regulatory decisions that they make. Mr. Coard urged meaningful participation by the community in the planning process. He urged meetings in the community which would be widely publicized.

Also very important is the franchise selection process; who owns CATV,who will control it. Mr. Coard said that ABCD believes in the integrity of existing neighborhoods in Boston. He believes that districting is best if established along existing community boundaries. Each neighborhood should have technical equality with other neighborhoods, and shouldn't reflect the affluence or non-affluence of the community. Mr. Coard suggested that more than two channels should be required for public use. These channels should be under the control of the community groups. Use of these two channels will be free; production costs assumed by the user. Mr. Coard proposes that there be at least one point of origination in each district and said that he supports the common carrier approach to cable. ABCD feels, Mr. Coard said, that it's better to have over protection than underprotection for Boston consumers.

Mrs. Schaffner, noting Mr. Coard's advocacy of CATV districts, asked how the City could ensure that the districts were fairly devised; that is that each district was equal to another. Mr. Coard said districting would take planning and perhaps could be achieved by having meetings in the neighborhoods, having communities offer alternatives. He urged that the districting be flexible, so that as the neighborhoods change, cable districts can be changed, too.

Mrs. Strauss asked Mr. Coard if what he envisioned to be good programming could best be achieved through private or municipal ownership. Mr. Coard said that he favored a mixed kind of approach, perhaps with many community controlled corporations.

The next speaker was Frank Whyte of Foundation '70, a cable research organization in West Newton.
Mr. Whyte said that Foundation '70 had recently been

concentrating on simulating the economic behavior of cable sys
Presenting a number of maps and charts, Mr. Whyte suggested th
his work dealt with a number of questions that had been raised
these meetings: one versus many systems; one versus many franc
one district for the City as a whole; one versus many franchis
areas. The most important question is economic viability. Foun
'70's study tests the economic viability of any particular are
It uses the number of homes, the number of potential subscribe
the number of miles that would have to be laid, and the number
underground miles. The number of homes and miles are the prime
parameters of a cable system. Foundation '70 asked itself: How
small a system can you build that will be economically viable?
What is the smallest economically viable system that can be bu

Undergrounding is a measure of the difficulty in construct
a system. Foundation '70's simulation model takes the cost of
building a system (without the head-end or antenna, but includi
undergounding costs) over a ten-year period. Foundation '70's
measure of viability considers what it calls 'the threashold
price' at a given subscription penetration rate. Mr. Whyte's ch
reflect the monthly prices that would have to be paid in any gi
area over a ten year period in order to reach the break-even pc
at a given subscription rate.

Looking at a map of the state as a whole,and the monthly p
that would have to be paid to reach this break-even point at 3
penetration, the City of Boston and some of the surrounding are
appear to be much more viable than does the rest of the State.
Areas outside the City were all less viable than the City itsel

On a map of Boston showing 10% subscriber penetration, a f
areas stand out as being viable. They include Brighton, parts o
Jamaica Plain, North Dorchester, Roxbury, South Dorchester, Eas
Boston, and the North End. Mr. Whyte said that these areas coul
charge relatively low prices for cable subscription and still b
even. Whyte said that with one system, more viable areas would
subsidizing the less viable ones if the entire City were paying
same rate.

Whyte's charts show that by the time penetration raises to
20%, the City becomes much more viable and that cable becomes m
less expensive. If penetration were to reach 70%, Boston would
highly viable and the CATV costs would go down still further. M
Whyte pointed out in response to questions that no City had eve
achieved 70% penetration, and that probably no City had ever ac
30% penetration. He said, too, that a number of factors that ha
been considered in the study, including the difficulty that an
operator might encounter in getting access to some older buildi
and an analysis of signal quality in various parts of the City,

An unidentified speaker rose to make a statement about the
abuses that a cable system could permit such as police surveill
and intrusion of privacy of people's homes. That statement foll

"On February 12, 1972 the National Archives and the FCC pu
in the Federal Register a report on cable television. The repor

dealt mainly with the development of controls of the new media. One statement of purpose read like this:' Our recognition of the importance and the promise of cable development led to our proposing rules and regulations concerned with program origination and a system of annual reports.'

"These annual reports would give the FCC information on the use of CATV (Community Antenna Television). The proposed uses the FCC sees as important are: credit checks, manpower utilization, systems to reach ethnic groups, and municipal surveillance of public areas * for protection against crime.

"This last category calls for further investigation into the proposed federal funding of surveillance projects involving CATV. Although the report suggests that such projects would be installed in public high crime areas, they would watch everyone.

"The FCC has set down extensive rules concerning the franchisement of CATV and its relays. Although the FCC requires 2500 member participants to provide a franchise, any 2500 people can agree on a project (i.e.crime surveillance) and once this project is set up, all in the community would be affected.

"The report cites many regulations on program origination and multiple ownership, but does little to establish rules for democratic project selection within a community.

"Prior to the report the FCC had employed RAND Corp. to study the possible effects of CATV on network programming. RAND has developed sensor equipment for the Defense Department in Vietnam. It has now developed televisions which can view a picture image through an ordinary CATV set. This reciprocal viewing can be done while the set is on or off. Who'll be watching US?"

In completing his statement, Mr. Whyte said, "Perceiving Boston in cable terms, and in economic terms gives you and the Mayor and the people who are concerned with access, concerned with ownership, concerned with franchising an enormous amount of flexibility. The economics of cable being proportional to the number of homes and the number of miles is very much suited to tailoring a cable system to local characteristics, whether it's the City of Boston relative to the State, or the areas within the City relative to the City as a whole.

I think if I were going to leave with just one thought, it would be that in seeing things in cable television terms, it's quite dramatic to recognize that there are neighborhoods in the City of Boston that, measured by an equal standard of viability, are far more viable than the cities and towns in the rest of the Commonwealth. This should indicate in some sense, first, the importance of what Boston does; second, the flexibility that the Mayor and the Consumers' Council have in choosing what configuration will be put into use her in the City."

* Underscoring from speaker's original text

The next speaker was Mr. Leim Kelly of the Boston Public Library.

Mr. Kelly said that the Boston Public Library can make a significant contribution to any system that may be developed in the City of Boston. Mr. Kelly said that the Library sponsors and supports a large number of cultural and recreational programs. He hopes that these programs and facilities can be open to the public by means of cable.

Some examples that Mr. Kelly offered that might be implemen on a one-way cable system are illustrated story hours, public plays by children, language programs, programming for shut-ins, programming for prisoners, and special old age programs. In a two-way cable system, the library could provide inter-active home library services, and could make available to the public its extensive film collections which are oriented towards special interest groups, which are not served now by the broadcast media.

The library feels that at least one channel should be dedica to library services and programs. Mr. Kelly recommended two books on cable which he's found particularly useful: one is Urban Cable Systems, published by the Mitre Corporation in July of 1972, and the Cable Television: A Guide for Citizen Action, also published in 1972.

Mr. Kelly, in response to a question from the floor, said th most of the programs that he mentioned that might be used on cab are already funded in the library budget for use in the public libraries themselves. At a very nominal cost or perhaps no additi cost at all, they could be aired on a cable network.

The next speaker was Mrs. Henderson of Roxbury.

Mrs. Henderson said that she had come to the hearings to sta that she opposes the development of a cable system for numerous reasons."The poor," she said,"cannot pay any more payments; the potential increase in electric power costs would impose a new burden on the poor."Mrs. Henderson noted that coaxial cable is st on utility poles or placed undergound."What does this mean?" she asked."Does this mean on existing telephone poles or will we have to pay the telephone company new higher bills for the use of thei poles? Who pays for laying the cable undergound? Will this lead to an increase in taxes? Will all taxpayers pay even if they don' have cable? Will cable take over the rights to sports shows, taki them away from the poor? Who will pay for educational programs? Will cable interfere with regular television? What will cable do to the environment? Will it add more to the already polluted envi ment? Who will own the cable system; will it be owned by utility companies? By outsiders? What is this discussion about districtin the City into seperate cable areas?"To me,"said Mrs. Henderson, this sounds like seperation instead of integration. I haven't hea any answers". She urged that the Mayor hold off on cable until the citizens knew just what was happening.

Mrs. Henderson pointed out that the residents of Roxbury should be given an opportunity to hear what cable is all about. Is the City going to do it, or will cable be developed by private enterprises? Is a public access channel going to compete with the existing channels? And finally,who invented cable television in the first place?

Mr. Frank Whyte of Foundation '70 attempted to answer many of Mrs. Henderson's questions. He said that many of the questions she raised could only be answered by the Mayor; that districting is up to the people. Cable would have to be laid underground, thereby causing the streets to be dug up. This question would have to be determined by the area in which the cable was going to be laid. Mr. Whyte pointed out, further, that cable companies generally pay the telephone and electric companies for use of the utility poles and that this price is reflected in the subscription rate.

Mr. Felder,of Malden Cablevision, pointed out that his company pays the utility companies for the use of their poles and that taxpayers or utility users who were not subscribers to the cable television system do not have that cost imposed upon them.

Mr. Duffy, of the Woburn Cable Television System, said that the amount of electricity used by a cable system is negligible and has little, if any, effect on the environment. Duffy said, with regard to the question of who invented cable, that it was first used in 1949 in either Oregon or Pennsylvania whose rural areas were unable to receive conventional television signals.

Tomas Rivera was the next speaker. Mr. Rivera recommended that the Consumers' Council consider the establishment of an independent watchdog agency to ensure that public access is carried out properly. He said that it could be established under the terms of the franchise, and the watchdog agency's functions would be to investigate complaints and to arbitrate disputes.

The last speaker remained anonymous and spoke from the rear of the room. She said that she was absolutely opposed to the development of a cable system anywhere. She said that it was of no benefit to the people; that it was another means of exploiting them, and that the television set will end up watching you while you watch it.

#Note: Mr. Borten spoke with the anonymous speaker at the end of the hearing, and asked if she would submit a written copy of her statement (which she had written out in front of her) so that we might include it in this report.

DOCUMENTATION OF SUPPLEMENTAL TESTIMONY PRESENTED BY TOMAS RIVERS OF CABLE ANTENNA TELEVISION INFORMATION SERVICE (CATVIS) TO THE BOSTON CONSUMERS' COUNCIL, OCTOBER 5, 1973

(submitted Nov. 1, 1972)

The Communication Act of 1934 was established to regulate all interstate communications by wire and radio. On the basis the Federal Communications Commission asserted authority over cable television in its Second Report & Order. Authority was imposed upon the medium on the grounds that it was a form of interstate communication by wire(by reason of its direct relation to the television industry.) In this way the analogy between CATV, Radio, and Television was established by the agency. The comparison was reinforced by the FCC in Minshall Broadcasting Co., Inc. 15RR 2d 394 1969 where it was stated CATV should be considered on a par with radio and television when considering the diversification factor in comparitive proceedings (See also Lorain Broadcasting Co. 14RR 2d 155 Rev Brd. 1968) This definition and resultant authority over CATV was upheld by the Supreme Court in 1968 in U.S. v. Southwestern Cable.

Therefore, with the comparison and similarities being established in FCC policy as well as agency and judicial rulings, an understanding and consideration of FCC and judicial policy must be considered basic and essential to any franchise deliberations.

To these ends CATVIS has compiled the substance of public policy decisions regarding the control and ownership of broadcasting franchises, with particular attention to CATV rulings. Furthermore, CATVIS concludes that in addition to fulfilling the financial, legal, and technical requirements, local ownership and control, are essential criteria which must be met in order to produce a franchise capable of meeting community needs and satisfying the public interest.

Public Interest II A Federal

1-2-3 In any licensing proceeding it has been FCC policy to demand the basic prerequisites of financial stability, technical expertise and other legal qualifications. This policy has been followed in pursuit of provisions of the Communications Act of 1934 and has been established to be inherently in the public interest.[1] Accordingly affirmative action of any applicant requires at base compliance with FCC technical standards; and disclosure and explaination of finances to the satisfaction of the FCC (I.E., proff that proposed system and programming could be implemented and sustained.)

II A 4 - Once the basic prerequisites of financial, technical, and legal qualifications have been met by parties in any proceeding where competing and mutually exclusive applications are being considered, the FCC has seized upon the comparative hearing as the basis of the decision. The legality and validity of this approach has been upheld by the judiciary on the basis of the 1st Amendment[1] amongst other criteria. It has further been stated that once basic financial capability is ascertained "the award need not go to the stronger"[2] and that the comparative proceeding-criteria was " well within the law . . . was not arbitrary, unlawful, or capricious".[3] In its 'Policy Statement on Comparative Hearings' (1 FCC 2d 393, 394) the FCC delineates the two basic objectives and criteria of the comparative process:

1.) Maximum Diversification of control of the Mass Media of communications.

This policy has been explained by the FCC to be used to insure "the widest possible dissemination of information of information from diverse and antagonistic sources,"[4] to protect against the "danger" of "concentration of control of the media of a community in a few hands"[5]. Accordingly preference is given in a comparative proceeding to the applicant who best serves the goal of diversification of control. The levels of preference for diversification of control are listed as: interests in the principal community service area, state and country, but the commission notes that the control of large interests elsewhere in the same state or region may well be more significant than control of a small medium of expression (a weekly newspaper) in the same community.

Judicial rulings have established diversification as legal and necessary criteria for the service of the principles of the 1st Amendment[6], and the public interest,[7] and have noted that a corporation which owns any media may be tempted to use it to serve other corporate interests.[8] The FCC applied this doctrine recently in the case of WHDH in Boston, refusing to renew the station's license citing it as a media conglomerate.[9] In his concurring statement Commissioner N. Johnson refered to this case as "a step, however small, back toward the commission's often professed but seldom evidenced belief in the benefits of local ownership and media diversity" and states that, "the door is thus opened for local citizens to challange media giants in their local community with some hope for success. ."[10]

2.) The second objective "best practicable service to the Public" incorporates several criteria in its determination:

The most significant factor considered to these ends is the integration of ownership and management. The commission explains this criteria in this way, "In securing the best practicable service, full time participation in station operation by owners is a factor of substantial importance because it is inherently desireable that legal responsibility and day-to-day performance be closely associated. Moreover, there is a likelihood of greater sensitivity to an area's changing needs and of programming designed to serve these needs, to the extent that the stations proprietors actively participate in the day-to-day operation of the station."[11] Further, in comparing and guaging the significance of applicants' integration the commission considers: percentage of stock held

by owners serving on a full time basis in operations,[12] and character and skills of same. But perhaps more importantly FCC and judicial rulings have established local residency (and thus control)[13] as an essential aim of this criteria and as a goal in itself dating back to the original licensing hearings through to the present.[14] In judging preference for local residency the commission shows increased preference with increased civic participation and duration of residency.[15]

Other factors which contribute to "best practicable service" but to a lesser extent are:

a.) efficient use of frequency

b.) proposed programming, with significance applied only to outstanding proposals evidencing "superior devotion to the public service".

c.) past programming - with credit or demerits given for exceptionally good or bad records. The FCC explained its intention of largely overlooking this factor in its proceedings . . . in WHDH Inc. et.al. as it placed an unfair burden on challenging applicants.

d.) and finally the character of ownership and management.

These factors form the basis for decision in any FCC comparative proceeding and as it would seem that most contested applications reach the comparative stage, significance should be applied accordingly. Integration and Diversification have been cited most often by the FCC as deciding factors[16] and in the course of its rulings a balance of the factors has been evidenced: an applicant favoured for diversification

will receive preference in comparative situation to an applicant favored for integration;[17] while an applicant with a substantial preference in integration will be favored over slight diversificatio and coverage preference;[18] an applicant with partially integrated stockholders whose local residency is enhanced by extensive participation in civic affairs is favored over an applicant with full-time integration but whose residency has been short (two years) and civic participation is limited;[19] and an applicant preferred for diversification and integration over an applicant who makes efficient use of the frequency.[20]

1. Red Lion Broadcasting Co. v. FCC 395 St. Ct. 1794, 1807 (1969) see also Greater Boston T.V. Co. v. FCC CADC 1970, 444 F 2d 841

2. Scripps-Howard Radio v. FCC 189 F 2d 677 1951 (USCA-DC)

3. Ibid.

4. Associated Press v. U.S. 326 U.S. 1, 20 1945

5. Lorrain Community Broadcasting Co. et. al. 13 FCC 2d 0106

6. Hale v. FCC 425 F 2d 556 (1970)

7. Greater Boston T.V. Co. v. FCC CADC 1970 444 F 2d 841

8. ABC-ITT Merger 9 FCC 2d 546 (1967)

9. WHDH Inc. et. al. 16 FCC 2d 001

10. Ibid.

11. WHDH Inc. et. al. see also Community Broadcasting Service Inc. 6RR 2d 589

12. Lorain Comm. B/casting et. al.

13. WHDH Inc. et. al.; Grand B/casting Co. 2RR 2d 327 (1964) Scripps-Howard RADIO v. FCC 189 F. 2d. 677 1951

14. Bamberger B/casting Services Inc. FCC 1946; L.B. Wilson Inc. #3RR 2d 61; Veterans B/casting Co. 4RR 2d 375; Massilon B/casting Co., Inc.4RR 2d 375; Sunbeam Television Co.5RR 2d 85; La Triesta B/casting Co.9RR 2d 295; East St. Louis B/casting Corp. 12 RR 2d 627; Citizens Communication Center v. FCC 22 RR 2d 2001 (U.S. App. DC 1971); Coastal B/casting Inc. 2RR 2d 409; Community B/casting Services Inc. 6RR 2d 589 (Rev. Bd. 1965)

15. Ocean County B/casting Co. FCC 2d 0953; Grand B/casting Co., 2RR 2d 327

16. WHDH Inc. et. al.16 FCC 2d 001; Ultravision B/casting Co., 11 FCC 2d 0394; Mt. Carmel B/casting Co. 13 FCC 2d 0155; Orange County Rdiotel Service Inc. 7 FCC 2d 0391; Cleveland B/casting Inc. 7 FCC 2d 0680; Farragut T.V. Corp. 8 FCC 2d 0279; Theodore Granik 8 FCC 2d 1068; WLCY Inc. et. al. 17 FCC 2d 0358

17. Bill Garret B/casting Corp. 13 FCC 2d 0007; Lorain Community B/casting Co. et. al. 13 FCC 2d 0106

18. Milam, Lansman Partnership 6 FCC 2d 0198

19. Ocean County Radio B/casting Co. 4 FCC 2d 0953

20. Charles Vanda 4FCC 2d 0655

Pts. 1-2-3

1. Yankee Network Inc. v. FCC 107 F2d 212; NBC v. U.S. D.
47 F. Supp. 940, 943 see also Communications Act of 1934
47 USCA 309, #24

BOSTON SAFE DEPOSIT AND TRUST COMPANY

JOHN M. NORTON
VICE PRESIDENT
617-722-7306

October 24, 1972

Maureen Schaffner, Chairman
Boston Consumers Council
Room 721
City Hall
Boston, Massachusetts

Dear Mrs. Schaffner:

I am writing in connection with the granting of the CATV license for the City of Boston. Unfortunately, I arrived at the last hearing just as the janitor was sweeping out the room; but I did have some observations to offer on the subject.

Watching television is clearly the number one leisure activity in this city and throughout the country. Upgrading the physical quality of the picture is a worthwhile objective. It would be sad indeed, however, if a national corporation devoted to accomplishing this, along with hazy prospects for improved general programming, were to gain control of such a powerful means of communication in our city.

One of the ground swells in this country is the reassertion of the rights of minorities, whether these are perceived in racial, economic, religious or geographic terms. An increasing awareness by people of their position in various minorities opens a significant market for what I call "sub-prime" programming--of not necessarily general, or national appeal. Boston is certainly a heterogeneous community, and although the composition of its neighborhoods has changed several times over the last 300 years, this characteristic continues to be dominant and cannot be ignored. It is very difficult to see how any company not under local control could react to the broader programming requirements of this kind of community.

Educational programming is still in its infancy. This is true both of the use of the television receiver in the classroom and in the home. To reach maximum effectiveness would require close coordination with the total educational system of Boston. Again, this seems to me a powerful argument for local control.

Boston is a capital-rich city; very few cities in the country have as great an amount of mobile capital per capita. A number of our large financial institutions are already engaged in producing CATV systems. This availability of local financing again suggests the desirability of local control.

Finally, although the voice and data communications potential is lea
often discussed, I think its potential relationship to the economic
future of the city could be critical, as the installation of a CATV
system could represent a quantum leap in the city's communication
ability which we may need to survive. Boston has no raw materials;
coke, no coal, no phosphates, no nothing. It is not a major entrepo
and the entire hinterland is struggling to survive financially and s
little population growth. It is not a crossroads. There is absolut
no natural reason why things should go through Boston. In summary,
Boston is in a terminal position in the economy, and the quality and
volume of our communications links could be critical.

What we do have in Boston is brains. There are several distinct nod
the Medical complex, University complex, Financial Services complex,
the Technological-Industrial complex. These brains have been in the
forefront of the knowledge explosion. But a knowledge explosion wit
a communications explosion will not be meaningful economically.

Much of the foregoing is in the realm of blue-skying. However, this
typical of the early stages of all major developments in communicati
(e.g., the railroad, the telephone, the airplane). The ultimate eco
impact always is only dimly and imperfectly perceived.

All this suggests at least as many questions as answers; however, I
some conclusions: First, that the franchise not go to a national op
who is interested in only the most narrow aspects of CATV; second, t
a local corporation have the license for the entire city; and, third
the corporation be structured so that all significant real or potent
users would be represented as a matter of right rather than as a mat
of courtesy. This would specifically include representation for tho
involved in local or other sub-prime programming, educators, major
communication consumers, and, finally, local financial interests.

Sincerely,

John M. Norton
6 Rollins Place
Boston, Massachusetts

JMN:jca

P.S. This is written as a citizen and does not represent a corporate
view of my employer or its parent corporation.

October 11, 1972 - Statement of Ms. Gordon for People Against National Identity Cards (PANIC)

THE THREAT OF CABLE TELEVISION

The most glaring dangers from what has become a nation-wide program to push cable t v (pay television) onto the public deal with the invasion of privacy, freedom-destroying surveillance of an entire population, repression of thought and action and freedom of speech, and electronic eavesdropping or cable-tapping. These dangerous potentials are made a reality by the two-way capability of the cable. In other words, your receiver is also a transmitter. While you watch it, it watches you.

Some of the earlier systems installed were one-way or optionally two-way. Since that time, technology has surpassed concern for legal protection. For example, the New Telephone Co. boasts the ability to convert all its systems to two-way monitors at a moments notice. Business groups, such as Electronic Industries Assoc., waiting to capitalize on the naive and trusting public recommend that all CATV include two-facilities, data systems and specially adapted print-out systems that can deliver the data collected in a matter of minutes.

In a move that ensures the capability of use as a national-electronic surveillance system, especially when focused in urban areas and selected communities, the F.C.C. report on cable t v (February, 1972) made it mandatory that all sets have built into the system two-way transmission. It is very incongruous that the so-called regulatory agency which should be primarily concerned with safeguarding the public's legal rights is instead allowing those rights to be sold to monopolies and conglomerates without alerting the public to the dangers involved. According to Jerrold Oppenheim of the American Civil Liberties Union, " The only two-way transmissi on that the F.C.C. discussed is for data and the only thing it told cable systems about that is to get ready for it...and when it comes to protection of privacy, the F.C.C. is absolutely silent."

A Boston Evening Globe article of February 1, 1972 clearly illustrates the most prominent dangers of cable t v:

"Spies armed with sophisticated listening devices could in the not-too-distant future tap your television set if it's hooked up to a two-way cable.

(P.A.N.I.C. Statement cont'd.)

"Without your knowledge, they could listen to and record the programs you watch, your transactions with department stores and banks, even your living-room conversations.

"Devices to prevent such spying are technically possible and specialists interviewed said the technology for converting television sets into pervasive spies has outstripped development of legal safeguards.

"Both public and private cable TV agencies have virtually ignored the possibility, explaining that other developments demand more immediate attention.

The chief of the F.C.C.'s cable tv bureau admitted that the cable can be tapped. The A.C.L.U. says that "Cable-tapping is no less a threat than wiretapping. Imagine a TV camera in your home controlled by the F.B.I."

The article continues: "Expansion to a two-way system would require equipping the home tv set with a transmission terminal and addition of television receivers in places using two-way tv communications." An A.C.L.U. director said 'The information being recorded might be of interest to some third party. And a representative of National Cable Television Assoc. "said virtually all one-way systems now being installed are being wired in such a way that two-way capability easily could be added later." The representative said " It is technically possible to shut out potential eavesdroppers with such devices as scramblers or switches attached to a television set blocking all radiation from it. The specialists interviewed said they know of no state or local agency that requires such safeguards in franchise agreements with cable operators.

"The critical point is shutting off the terminal at home, but is that enough?

"Because of its capacity to radiate energy, the television set even while turned off could still pick up conversations and relay them to wiretappers, he said.

"For example...you're sitting in your home at a cocktail party. Suppose the C,I,A. was sitting outside in a van equipped with sophisticated equipment. Your TV. set could be transmitting your conversation to them...That's essentially what could be done."

It is necessary to re-emphasize the threat of the cable. Signals from home receivers can be transmitted back to the sending station. Since the cable can simultaneously receive

and transmit, your home, school, library, office, etc. could automatically be monitored by members of the police dept. or any other government body or agency.

A $1,250,00. plan proposed for Atlanta calls for low-light-level video tape cable tv cameras to be installed in heavily populated areas, commercial and industrial locations, schools and public buildings. Receiving equipment would be located in the Atlanta police headquarters and would be monitored by seven officers twenty-four hours a day.

A similar system is already operating in the Polk county (Florida) school system where cameras take pictures every thirty seconds. In addition, junior and senior high principals are equipped with hand-held cameras for surveillance of unmonitored areas. It should be quite easy to imagine how few students, or members of the population at large would be willing to participate in assemblies, rallies, pickets, demonstrations, boycotts, and other political activities if it meant surrendering to some unseen agent or agency a photograph or face-print, a voice-print, and the right to have your personal or political activities spied upon and recorded.

It should be enough to say that with the clear and present threat to our personal and political freedoms inherent in the cable tv systems, with the lack of legal and physical safeguards against cable-tapping and surveillance, and with the inability or unwillingness of regulatory agencies to provide such safeguards, that the promotion and installation of CATV (pay television) should be and will be loudly condemned. To go one step further, any attempt to snow the public into accepting the CABLE must be resisted at all levels ---and prevented!

Appendix G

A Study of a Two-Way CATV Layout For Boston

BY

John E. Ward
(Deputy Director, MIT Electronic Systems Laboratory)

April 23, 1973

A STUDY OF A TWO-WAY CATV LAYOUT FOR BOSTON

BY JOHN E. WARD

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A. Introduction

This report presents the results of a study of the possible layou of a two-way CATV system for the City of Boston, taking into account the current information and opinions on how a cable network should be organized to permit high-quality downstream distribution of a large number of program channels, as well as to provide what is hopefully sufficient capacity for two-way services that may arise or develop in the future. Particular topic discussed are the implications of a two-way transmission requirement on the cable network (as opposed to the two-way communications that might be carri out on such a network), the data processing requirements for various subscriber services that may be carried out via two-way digital data transmiss on the cable, and finally, an examination of a possible system layout for t City of Boston, based on the distribution of housing units and the require-ments developed earlier.

B. What is the Two-Way Problem?

The term "two-way" has two different connotations in regard to a CATV system. As applied to the cable distribution plant itself--the "commu ication highway"--it simply means that the cable and its amplifiers are arranged so that signals can travel in both the upstream and downstream directions along the cable route, instead of just the downstream direction as in traditional CATV distribution systems. The other meaning has to do with the types of new communications or services that can or may be implemented on such a two-way cable plant, which range from the simple to the very complex. The distinction between these two meanings may seem artifical but it is important in discussing the dilemma facing everyone concerned wit CATV at this time--how to specify or install the now-required two-way cable capability without a clear understanding of the directions that two-way services may take in the future. This situation is further elaborated upon in the paragraphs below.

1. Two-Way Cable Plant

Many manufacturers now make two-way amplifiers for single- and multiple-cable systems, and a number of CATV systems are already experiment

with two-way transmission or installing cables and equipment in such a way as to permit future expansion to two-way transmission, either in parallel but separate cables for each direction, or in different frequency bands on one cable. In fact, the March 1972 FCC Rules and Regulations require all new cable systems in the top 100 markets (85% of the U.S. subscriber potential) to be installed so as to permit easy upgrading to two-way transmission. All existing systems in the same markets must also comply with this same requirement by 1977.

As will be discussed more fully in Section C, the major impact of this requirement for eventual two-way transmission capability is that if it is anticipated that TV signals may originate at any point in the system, a two-way trunk can be no more than half as long as a traditional one-way trunk, reducing by at least a factor of four the size of the area that can be served from a single headend. This is because an upstream signal that is to be distributed on a downstream channel must pass through amplifiers in both directions, and it is the total number of amplifiers through which a signal passes that limits cable length. For example, 32 amplifiers is now considered the maximum trunk length for 30-channel one-way systems, and a two-way trunk must therefore be limited to no more than 16 amplifiers. The two-way transmission requirement thus results in a different layout of the cable network--with many more sub-headends or "hubs".

2. Two-Way Services

A two-way cable plant, as described above, is not yet a two-way communications system until the signals or type of communication activity carried out on the two-way cable plant are defined. In its 1972 Rules and Regulations, the FCC does not specify what type of two-way communication is envisaged except that its two-way requirement on the cable plant can be met by providing "technical capacity for two-way communication at least on a non-voice basis". This simply acknowledges the fact that two-way cable communication is in such an early stage of development, both technically and in the identification of new services that will be viable in the subscriber marketplace, that it would be premature to specify particular types of

signals, terminals, or services.

From a technical viewpoint, the possible two-way services are perhaps limited only by the imagination. It is possible, for example, to establish voice, continuous video (television), or digital data channels on a two-way basis, or any combination of the three. Digital communication on the cable can bring the computer world into every home, and with proper terminals and interconnections between head-end computers and other computers, subscribers could have access to almost any conceivable service--financial transactions, shopping, information banks, public safety, education, etc. Further, there are new developments in time-shared use of television channels--digitally addressing single frames of a standard 30-frame-per-second television signal to different individual subscriber terminals suitably designed to "catch" and display them for viewing. This technique, called "frame grabbing" is really a type of facsimile transmission that can transmit vast amounts of either pictorial or textual information on demand.

There have been so many published enumerations of the wide variety of services that could be made available to subscribers when the "wired nation" is a reality that any listing here would be redundant. The report of the Sloan Commission on Cable Communications, and the various reports issued by Rand and The Mitre Corporation rather completely spell out the possibilities.

The problem facing communities, regulators, and industry alike is that the present cost of doing some of these things is relatively inexpensive while for others it is very expensive, and no one yet knows which of these new and innovative services people will be willing to use or pay for. At the moment, adding pay-entertainment (first-run movies, special sports events, etc., on an extra-charge basis) seems to be the only clear direction in new services, but this can be done on either a one-way or two-way system.

3. Summary

To sum up this introductory discussion, an attempt has been made to make clear the distinction between a two-way cable plant and the two-way

communications services that may be carried out on it. Unfortunately, the two are not completely independent, since both the capacity of the cable plant (measured in terms of the total number of channels per trunk and the ratio of upstream to downstream channels) and its network layout set an upper limit on possible two-way services. Given the present state-of-the-art and the uncertainties as to what two-way services will be desirable or likely in the future, the problem in laying out a new system is to provide maximum flexibility for meeting possible future requirements without making the initial installation so costly that it is not economically viable in the meantime, i.e., to hopefully strike a proper balance between the known present and the uncertain future.

C. Limitations on Service Radius of Trunks

Irrespective of communications capacity questions that may affect the organization of a cable network, the electrical characteristics of the cable and the amplifiers set an upper limit on the length of trunk cables and thus have a major influence on system layout in a large urban area such as the City of Boston. This section first discusses the allowable trunk lengths for the classical type of one-way CATV distribution system (for various cable sizes), and then the limitations brought about first by increasing the number of channels beyond 12, and then by adding a requirement for two-way transmission.

1. Cable Attenuation

All coaxial cable sizes can carry the full 5-300 MHz bandwidth used in CATV systems, but with a loss characteristic that varies as an inverse function of the diameter of the cable. Losses (signal attenuation) are of course made up by inserting amplifiers with a gain of about 15:1 (22 dB) at appropriate intervals in the cable, and since losses are smaller the larger the cable, amplifier spacing is also an inverse function of cable diameter. At the same time, cable cost rises rapidly with cable diameter. Figure 1 shows cable loss per 100 feet and cable cost per 1,000 feet for the five standard cable sizes between 0.340- and 1.000-inch diameter. These figures

are for jacketed, polystyrene-foam aluminum cable with copper-clad aluminum center conductor.

Amplifiers cannot be used indiscriminately, however, Because each amplifier adds a little noise and distortion, there is a limit to the total number of amplifiers that can be used in cascade between a cable subscriber and the system headend. Thus system layout and choice of cable sizes for the main trunks, sub-trunks, and feeder cables of a system is primarily based on keeping amplifier cascades within allowable limits for the longest cable route(s) in the system, with cost also a factor. Simple 12-channel, one-way systems have been able to operate successfully with up to 50 amplifiers in cascade, but this number has had to be reduced to a maximum of 32 amplifiers in 30-channel systems because of the greater bandwidth and the increased number of cross-modulation products.* Allowable one-way trunk lengths with various size cables are then as follows for a 300-MHz system:

Cable Size	Amplifiers/Mile	Greatest Trunk Length (One-Way System)
.500 inch	3.64	8.8 miles
.750 inch	2.35	13.6 miles
1.000 inch	1.7	18.8 miles

It should be noted however that the above figures are just for trunk cables. Sub-trunks and feeders that distribute signals from the trunk(s) are run at higher signal levels than are used in trunks, and therefore each of the distribution amplifiers in these cables contributes much more cross-modulation than a trunk amplifier. Available application data* on trunk/distribution cascades indicates that distribution amplifier cascade off a trunk must be limited to four from the 1st through the 8th trunk amplifier, to three from the 8th through the 25th trunk amplifier, and to two thereafter (see Fig. 2). Cross modulation increases as temperature decreases and even these numbers are marginal at extreme low temperature (-10°F).

*"System Applications", Kaiser CATV (now a division of Theta-Com of California), 1972

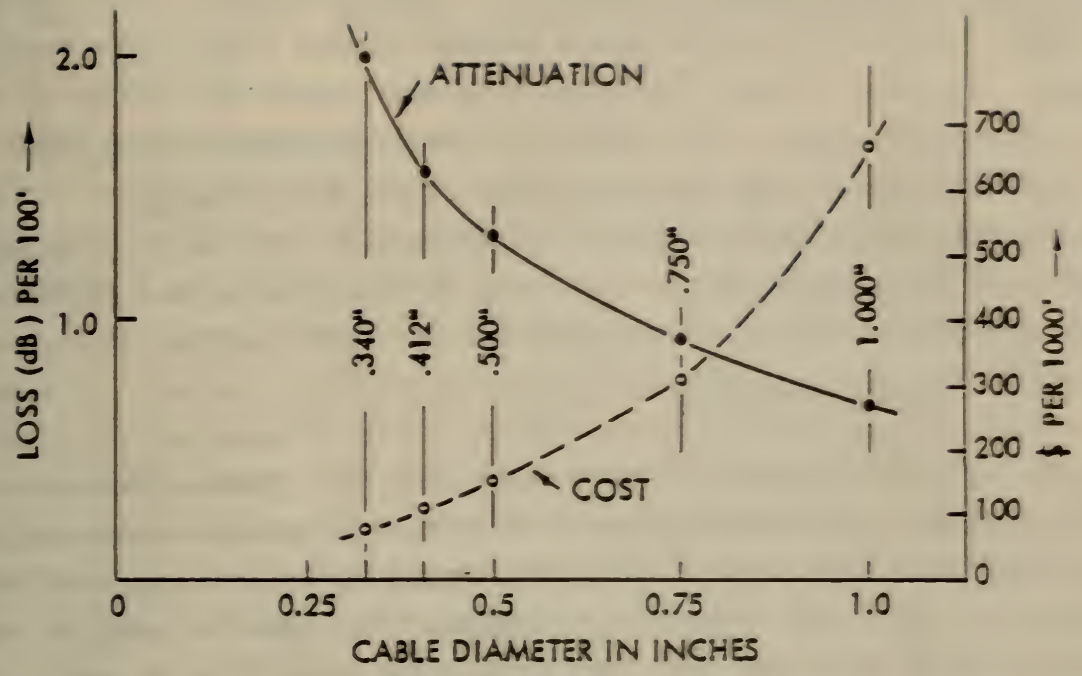

FIG. 1 ATTENUATION AND COST DATA FOR CATV CABLE

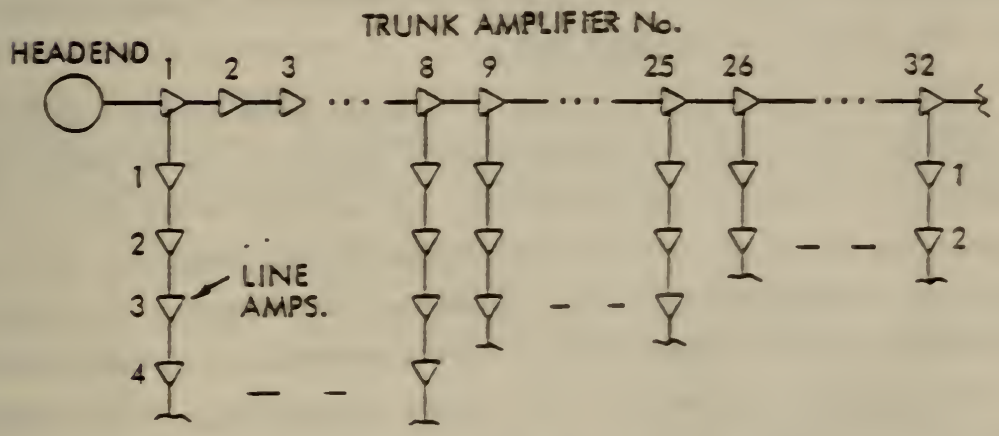

FIG. 2 ALLOWABLE LINE AMPLIFIERS AS A FUNCTION OF TRUNK AMPLIFIER NUMBER

The above data indicates that permissible distance off a trunk decreases with trunk length, whereas the distance between trunks radiating straight outward like spokes from a headend becomes larger with trunk length. In order to avoid having gaps between trunks that cannot be reached by distribution cables, the trunks in a generally built-up area can't run in straight lines to the distances shown in the preceding table, but must zig-zag back and forth as necessary to bring every part of an area within reach of a distribution cable. Thus the service radius for a given trunk cable size will be considerably less than the trunk length.

2. Two-Way Operation

Two-way operation results in an even more drastic limitation on trunk length. The maximum 32-amplifier cascade discussed above applies to the total path (both upstream and downstream) between the source of a TV signal and the TV set on which it is viewed. In order to permit a remote TV origination to be inserted into an upstream channel at the end of a trunk and then be sent out from the headend on downstream channels for viewing, there can be no more than 32 upstream and downstream amplifiers combined. Since in general a trunk will have an upstream amplifier for every downstream amplifier,* two-way operation thus cuts allowable trunk length in half, i.e., to 16 amplifiers.

The above 16-amplifier limit on two-way trunk length applies to a single headend. Obviously if an origination signal is to be passed on to other headends in a multi-headend system, the amplifiers (if any) in the interconnecting trunk(s) must also be allowed for in computing total cascade resulting in a further reduction in allowable trunk length. An example of such a calculation for a hypothetical Boston system is presented later on.

The combination of all of the above factors means that two-way trunk lengths in a large urban area such as Boston should probably be limited to about 8-10 amplifiers, or about 4-5 miles with 1-inch cable. Allowing further for trunk "meander", the service radius of a headend or sub-headend is probably about 2-1/2 miles, except where trunks can run in a reasonably

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*"System Applications", Theta-Com, Ibid.

straight line. It is clear therefore that Boston cannot be served with two-way CATV from a single headend. A possible four-headend layout is presented later in Section E.

D. Two-Way Implementation

The particular thrust of the present study has had to do with the network organization of a two-way cable system for a large urban area such as the City of Boston, given the types of two-way communication which have been postulated and for which at least prototype hardware designs are now available. The major problem in studying the network issue is that although the information capacity of the various two-way transmission techniques can be easily calculated, predicting the two-way traffic that might be generated by subscribers at any future time is an impossible task for the reasons that were discussed in Section B, i.e., no one knows how rapidly two-way services will be made available to subscribers or how extensively they will use them once they are available. These issues have been more fully presented in a paper prepared under the previous Model Cities grant.*

This section first discusses the estimated per-dwelling-unit cost of installing a dual-cable plant with two-way data capability in Boston as a basis for determining the cost multiple of equipping subscribers with terminals so they can use it. It then discusses the information transmission capacity of representative two-way technologies, the traffic capacity of head-end processors, and finally, the implications of these capacity issues have on the network layout of a two-way transmission system for Boston.

1. Estimated One-Way and Two-Way Capital Costs

A general survey of two-way CATV technology was made by the author in 1971 as part of the technical study for the Sloan Commission on Cable Communications, perhaps two years after the start of the burgeoning interest in two-way cable. Present technological and cost status is still about the same, since very little has occurred in the way of new concepts or technology in the intervening two years. Also, the various trials and experiments with

*"What Belongs on the Cable?", J.E. Ward, 21st Annual National Cable Television Association Convention, Chicago, Illinois, May 14-17, 1972.

two-way communications have come along much more slowly than most enthusiasts predicted at that time, or have been at a smaller scale than predicted--partly for technical reasons, but mostly because of the costs of moving into the two-way world and the difficulty operators have in deciding which ones of the many possible new services and types of communications that have been discussed are likely to be economically viable in the near future or the long term.

As was pointed out in the Sloan Commission report, the per-subscriber cost of building a two-way cable plant is relatively minor compared to the cost of subscriber terminals and headend equipment necessary to implement some of the communication services being discussed. For example, suppose that $75.00-$100.00 per house passed is taken as the cost range for the two-way cable distribution plant itself (this assumption is discussed below), or $150-$200 subscriber for 50% penetration. With presently quoted or estimated costs of $300-$500 per subscriber installation for various types of two-way terminal devices, and additional headend operational costs to provide two-way service, the present typical subscription charge of $5.00 per month for one-way service might have to be increased to $15.00-$25.00 per month for two-way service, assuming that subscriber payments remained the main source of income. Of course, these present terminal costs are likely to come down considerably in the future if large-volume production ever sets in, but it is generally agreed that even with such cost improvement, a basic two-way capability (including terminals) will cost at least twice as much per subscriber as a one-way system, with a higher ratio for expanded capability.

The $75.00-$100.00 cited above as the per-house-passed capital cost range for a dual-cable, two-way system seems a reasonable estimate and was arrived at as follows. Boston has roughly 240,000 dwelling units and 788 street miles. Since over much of the City the streets are in a two-way grid pattern, the distribution cable (trunk and feeder) mileage necessary to reach every dwelling is probably about three-fourths of the street mileage, or about 600 miles.* (With this assumption, the average density is

*In the Mitre study of Washington, D.C., they estimated cable mileage as 1,074 miles, 87% of the 1,222 street miles. The number of dwelling units in Washington (263,000) is almost the same as Boston, but the area is a third larger (61 square miles); thus, a slightly smaller percentage of cable miles to street miles seems reasonable for Boston.

400 dwelling units per cable mile, which is above the average density of 150-200 units per mile for most cable systems, and therefore represents an economic plus factor for a Boston cable system.) If we assume that half of this cable mileage is underground construction at an average cost of $35,000 per mile and the remainder is aerial construction at an average cost of $12,000 per mile, total distribution cable cost is $10,500,000 plus $3,600,000 = $14,100,000, or $58.30 per dwelling unit.

The basic estimate of $58.30 per dwelling unit as the distribution plant cost for a dual-cable, two-way capability may be compared with the figure of $65.00 per household developed by Baer* for a very similar (but hypothetical) city. His System C also has 240,000 households, but over 2.5 times as many cable miles (1,600), and only 5% underground construction. These last two factors approximately balance out compared to Boston, thus the estimates are fairly comparable.

To arrive at the total capital cost per dwelling unit, the pro-rata share of other capital costs must be added. As will be described in Section E, a Boston system would have at least four interconnected headends, which might cost $500,000 each for one-way service, including the two-way interconnection trunks (special cable or microwave) and local origination facilities. Another $2,000,000 might be spent on computers for two-way data service to subscribers, service equipment, pre-opening expenses, etc., bringing total capital investment for plant (not including any subscriber devices) to about $18,000,000, or $75.00 per dwelling unit.

Note that the cost of installing subscriber drops has not been included in the $75.00 figure above, because this cost is usually included on a per-subscriber (not a per-dwelling-unit) basis. It is also usually partly recovered as a direct subscriber charge at the time of installation. Drop costs in Boston will probably be high because of the large percentage of underground construction and multiple-dwelling-unit structures, and may average $50.00 more each (drop cost for the Malden system is $32.00). This seems too large a cost to recover completely as an installation fee, thus

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*"Cable Television: A Handbook for Decisionmaking", Walter S. Baer, Rand Report R-1133-NSF, February 1973, Chapter 3.

we might arbitrarily add as much as $25.00 per dwelling unit as a capital cost, which would bring total estimated per-dwelling-unit capital cost to $100. Thus the cited range of $75.00-$100.00 per dwelling unit.

2. Two-Way Transmission Capacities

The forms of signals for two-way transmission are digital data, television, and voice, and each has different implications on the capacity issue. Voice and TV channels are discussed in (a) and (b) below; digital channels are discussed in paragraph 3.

a. Voice channels

It is expected that requirements for voice channels will always be relatively small, perhaps no more than a dozen or so per trunk for conference hookups, audio in connection with local originations, etc., and since each voice channel takes only 4-6 kHz (a factor of 1,000 less than a television channel), voice channels represent no capacity problem.

b. TV channels

Television channels for two-way services are of two types: time-division-multiplexed "frame grabber" channels in the downstream direction, and normal continuous TV channels in both directions. One downstream frame-grabber channel per trunk would seem to provide sufficient capacity for this type of service. For example, one such channel can transmit 216,000 different frames per hour, or an average of one frame every three minutes for every subscriber on a 10,000-subscriber trunk. Assuming that only a small fraction of the 10,000 subscribers would be using this service at any given time, one frame-grabber channel should provide a response time of a frame every few seconds for each active subscriber. (This assumes that automated frame retrieval files capable of extracting and scanning random frames on demand at a rate of up to 60 per second will be available. Presently available retrieval devices are considerably slower and could not keep a frame-grabber channel busy.) Note also in connection with frame-grabber channels that one file scanner can be shared across all trunks, or each trunk can have its own file scanner, multiplying the total system frame-grabber capacity by the

number of trunks. If there were 20 trunks, and each had a file scanner that could retrieve 216,000 frames per hour, total system capacity would be over four million frames per hour at a bandwidth cost of only one channel per trunk!

Expected uses for continuous two-way TV channels on a normal trunk are for remote originations (either for general viewing, or for restricted-access viewing such as group conferences or education for the handicapped), point-to-point two-way television hookups (medical diagnosis, municipal department or school interconnections), and so forth. The capacity demands here are obviously extremely difficult to estimate, given the cost of cameras and channel modulators for inserting TV signals into the cable (i.e., for origination), and the fact that only limited experiments have yet been conducted to determine the practical usefulness of many of the possible types of two-way TV connections. The best that can be done to provide for a reasonable number of channels for two-way TV use is (1) to install trunks in a hub configuration (keeping the number of subscribers per trunk at about 10,000 or less), (2) to install dual trunk cables with flexibility for changing the ratio of upstream to downstream channels, and (3) to provide additional capacity in the interconnecting trunk cables between hubs. Also if municipal or school needs for future two-way TV interconnections can be established, and appear to place an undue load on general system capacity, consideration should be given to installation of separate cables or cable networks serving the relatively small number of locations involved. The Mitre study for Washington recommended three special networks for non-entertainment uses: municipal, Federal, and business.

3. Digital Transmission Capacities

In the Sloan Commission report, the author stated that a one-megabit, two-way data channel could as a limit interrogate (poll) each of 4,000 subscribers at a rate of 10 interrogations per second--each such interrogation including transfer of one message character (8 bits) to the subscriber and receipt of one message character from him. This calculation was based on a 12-bit binary address for each subscriber (one out of 4,096) and eight message bits, or 20 bits total per interrogation. It also assumed that the

round-trip propagation delay times for each subscriber terminal are compensated such that the timing guard band (to prevent response overlaps) for each interrogation can be as little as five bit times, or 20 percent of the 25-microsecond subscriber interrogation interval.

The interrogation rate in a given system depends on the channel bit rate, the number of bits per interrogation (address plus message), and the guard time allowance. In general, the rates will be a bit slower than the example above because of more address bits (more subscribers on a trunk), extra control bits, and a larger guard time allowance. For example, the current Hughes/Theta-Com SRS system* apparently has a 50,000-subscriber addressing capability and allows about twice as much time per interrogation--50 microseconds. It thus interrogates subscribers at a 20,000-per-second rate, or once every 2.5 seconds for every subscriber in a 50,000 subscriber system. This is still a very substantial communication capability, and can easily be increased if necessary by lowering the number of subscribers per trunk or using more than one two-way data channel per trunk. The bandwidth requirements of a two-way data channel are discussed below.

As mentioned previously, a two-way data channel of the type described above takes very little space on the cable--approximately 6 MHz (one TV channel) in each direction for a one-megabit data rate. The data is transmitted in the form of a serial bit stream modulated onto a radio-frequency carrier, and each terminal contains a fixed-tuned receiver and data demodulator for the head-end transmission, and a modulator and fixed-tuned transmitter for the return path. The data channel frequencies used and the type of modulation presently vary from manufacturer to manufacturer, and may never be standardized unless there is equipment industry agreement (perhaps through the Electronic Industries Association) that there would be an advantage in doing so, pressure from operators to standardize, or regulatory action by the FCC. In any case, there would probably have to be multiple standards because of differences between cable systems (single-cable, dual-cable,

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*"SRS El Segundo Interim Test Report", Richard T. Callais, 21st Annual NCTA Convention Transcript, May 14-17, 1972, pp. 384-407.

variations in upstream-downstream crossover frequencies, etc.). Actually, standardization at this time would be premature, and is not really an issue in franchising or operation. Each system obviously has to have terminals compatible with its own head-end computer(s), but interconnections between systems will be computer-to-computer and can be on entirely different standards. It is in the system interconnection area that early standardization activity (data rates, interfaces, message formats, etc.) would seem to be warranted.

Two of the data terminals involved in current experiments are quite similar, although the detailed variations referred to above are quite evident:

	Vicom Terminal	Theta-Com SRS
Data rate	1 megabit	1 megabit
Poll channel frequency	108-114 MHz	110 MHz
Poll channel modulation	FSK	PCM (?)
Reverse channel frequency	8 MHz	21-25 MHz
Reverse channel modulation	PSK	PCM

Note: FSK = frequency shift keying
PSK = phase shift keying
PCM = pulse code modulation

A completely different type of system has been developed by TOCOM, Inc., and is scheduled for an experiment in Irving, Texas. The TOCOM system is organized as an interrogation-only system, with no provisions for transmission of messages to subscribers.* The strategy of this system is to interrogate subscribers in groups, and have each group respond on a separate return channel in the 10-30 MHz band on the cable. Subscriber terminals are organized into up to 30 groups of 1,000 terminals each, with addresses repeating in each group, and each terminal has seven 16-bit response-word registers which are individually addressed as part of the head-

*"TOCOM System: Bi-Directional Cable Television Information and Control Transmission System", W.B. Osborn, Cablecasting, Vol. 8, No. 1, January/February 1972, pp. 27-30.

end poll code: one register per poll. When the head-end transmits an address/word code, all same-numbered terminals (one in each group) respond with the requested 16-bit response word; thus one poll results in up to 30 16-bit response words at the same time, each on its own channel.

Despite the parallel interrogation, the TOCOM system operates at a much slower effective rate than the Vicom and SRS systems above. Since the interrogation (poll) interval is 30 milliseconds, the effective response-word data rate per trunk is only

$$\frac{30 \text{ groups} \times 16 \text{ bits}}{.030 \text{ sec per poll}} = 16{,}000 \text{ bits/second.}$$

This is one-sixtieth the rate of the Vicom or SRS systems. At this rate, it takes 30 seconds to poll 1,000 addresses (30 x 1,000 = 30,000) terminals for one word each, or 3-1/2 minutes to get all seven response words from each terminal. Also since terminals are addressed in groups, there is no way to send a message to a specific terminal. The TOCOM approach does not appear to be the wave of the future in two-way responsive systems.

4. Processing Requirements

Data processing requirements for head-end computers are very difficult to estimate because they depend so heavily on what two-way services are offered, and how often subscribers use them.

A small mini-computer in the $15,000-$25,000 class (including a hardware polling interface) can easily handle one (and possibly two or three) one-megabit, two-way data channels so far as polling, simple response analysis, and interchange of message and response characters for active subscriber terminals with other computers are concerned. This is on the basis that such computers perform a million or more instruction cycles per second, and there are 25-50 instruction cycles available per poll cycle even under the very unlikely event that every subscriber terminal on a trunk was simultaneously and continuously receiving and transmitting message and response characters.* Actually, only a few percent of the subscribers on

*The Electronic Systems Laboratory has recently constructed a highway traffic monitoring and sign control system which operates full-duplex on a two-way, one megabit CATV-type cable, and in which a $10,000 PDP-8 computer handles all communications and control functions with time to spare.

a trunk could be expected to be actively transmitting or receiving messages at any given time. Both the Vicom and Theta-Com systems expect to be able to handle up to 50,000 terminals per mini-computer. Mitre Corporation also estimates that for reasonable response times, no more than 50,000 subscribers can be handled by each computer, and that at least one computer would be required per hub for simple subscriber response services (SRS) in their proposed system for Washington, D.C.* Their Electronic Information Handling (EIH) system would require 95 additional computers, for a total of 100.

If a system operator wishes to provide various computer services to subscribers (information retrieval, computation, game playing, etc.) that require a substantial number of computer instructions per transaction, then computer loading may become a problem. The solution here is not to use larger computers for the polling function, but to add additional computers as necessary for the functions to be performed and the demand on them. The strategy here would be to use the same small mini-computers for the real-time polling and response analysis functions, and transmit only the appropriate active responses to the proper computer(s) to handle them. Thus the headend data processing equipment can grow gracefully as the need develops, without necessity of replacing equipment as processing requirements increase.

5. A Network Strategy

Based on the above discussions, a network pattern for a multi-headend situation such as Boston begins to emerge. Polling and response analysis should be performed on a trunk-by-trunk basis, with small computers located in the hubs (or sub-headends) as necessary to handle the subscriber terminals served by that hub. Here again, the number of trunks that can be handled by one computer will vary with the number of subscribers per trunk and their demand on the system services, and increased demand can always be handled by adding additional computers and reducing the number of subscriber terminals served by each. For example, if a hub serves 50,000 subscribers with five trunks (10,000 subscribers each), one computer would probably handle all five trunks initially (the Theta-Com SRS system expects to handle

*"Urban Cable Systems", Mitre Report No. M72-57, May 1972, pages B-5, B-27, and VI-12.

50,000 subscribers per computer). If this computer became overloaded, t additional computers could be added, each serving fewer trunks.

The more sophisticated processing services that might be offer should probably be concentrated at the main headend rather than distribu at the various hubs. The polling computers would then transmit only act requests over the interconnecting trunks to the central processor(s) and receive active messages from it (them). Since only a few percent of sub scribers will ever be active simultaneously, the required data rate on t interconnecting trunks can probably always be provided by one two-way da channel per interconnecting trunk. If however polling were done from th main headend, then the number of data channels needed in the interconnec trunks would vary with the number of subscribers that could be handled i each poll group.

In the system layout discussion which follows in Section E, it appears that for reasons other than two-way data traffic volume, a Bosto system should probably have about 10,000-15,000 dwelling units per trunk and at least four hubs (sub-headends). This fits in very nicely with th above strategy. With four hubs each serving 60,000 dwelling units, poll computers in the hubs would each have to handle about 30,000 subscribers 50% penetration. At higher penetration, additional polling computers co be added as necessary up to a limit of one per trunk (10,000 subscribers each), which clearly would always provide adequate traffic handling capa

6. Reliability

One point which is not often mentioned in two-way system descr tions is the reliability factor. Computer technology has reached a stag where they run for months without failure, but when there is a failure, often results in down time of several hours up to a day or more. Depend on how much stress is placed on minimizing (or completely eliminating) d time, various levels of backup operation with redundant computers are av able, with cost depending on how much time is allowable for switchover a whether it is permissible to temporarily disconnect an active transactio A simple manual switchover to a second computer with loss of transactio

in progress costs little more than the second computer. Manual switchover with minimal loss of transactions in progress requires an additional backup memory device that is updated at intervals to match the memory of the active computer, and is also accessible by the backup computer. Automatic switchover without any loss of transactions in progress is also possible, but requires backup memory updating on a transaction-by-transaction basis and is even more costly.

The data reliability issue is of course tied in with the reliability of the cable itself, which can also have failures and downtime (cable breaks, amplifier failures, etc.). It would seem that some level of computer backup should be provided by an operator, but that the proper balance should be struck between overall service uptime level and cost. For example, reducing computer downtime to zero may be meaningless in view of system downtime from other causes.

E. System Layout Considerations for Boston

This section examines the distribution of housing units in Boston, and shows that it would be feasible to cable the entire city for two-way service from four headends, using the trunk-length data developed in Section C. It appears however that either sub-band cable or microwave interconnections will be needed between headends in order to reduce distortion in these links and permit TV originations at any point in the city to be viewed at any other point.

1. Dwelling Unit Distribution

The distribution of housing units in Boston can be determined with a fair degree of resolution from the tabulated 1970 Census data. Boston is divided up into 148 census tracts averaging about 1570 housing units each, and the number of housing units in any desired areas such as Charlestown (5,119) or Brighton (25,324) can be determined by adding up the totals recorded for the appropriate census tracts.

It is of interest in passing to note that the tracts vary quite a bit in area. One might presume that this variation would be related to the density of housing (i.e., to yield about the same number of housing

units or persons per tract), but this does not seem to be the case. For example, Tract 406 in Charlestown and Tract 7 in Brighton are approximat equal in area, but have 101 and 5,482 housing units respectively. Altho the variation in housing units per tract is not particularly important f the present purposes, Fig. 3, has been prepared to show the distribution in units of 500 housing units. In Fig. 3, the vertical bars show the number of tracts having housing units in each range from 0-500, 500-1,00 etc.; the solid curve shows the approximate total housing units represen by each range; and the dashed curve (right-hand scale) shows the cumulat total for Boston as a whole. These last two curves are based on average values for each tract range, not the exact tract counts, but are fairly accurate since the cumulative total calculated on this basis is only off about 5,000 units. A second point with respect to the census tracts is that their shapes are quite irregular, and since their areas are not giv in the printed listings, it would not be a particularly easy job to comp housing unit densities on a unit-area basis. This is not of prime conce for the present purposes, but would of course be of interest in actual s mapping for the city. Mr. Walter Nissen of the Unitel Census Program at has informed me that more detailed information is contained in the magne tape version of the 1970 Census Data, and that housing unit density can extracted on a block-by-block basis if desired.

For the present purposes, we are interested in finding the dis bution of housing units by general districts of the city, and this can b done directly from tract map and the tract listings. As a first cut, th city was divided up into ten arbitrarily bounded zones, selected primari (but not entirely) on the basis of the tract numbering system, which has for example, all Charlestown tracts in the 400's, all South Boston tract in the 600's, etc. The result is shown in Fig. 4, from which some inter ing observations can be made. First of all, zones numbered 1 through 5 contain 127,234 housing units (55% of the city total) in a fairly compac almost circular central area about 5 miles across. Note that the Back B area appears to have the highest housing unit density of all the zones shown. Second, the southwestern end of Boston is roughly a rectangle

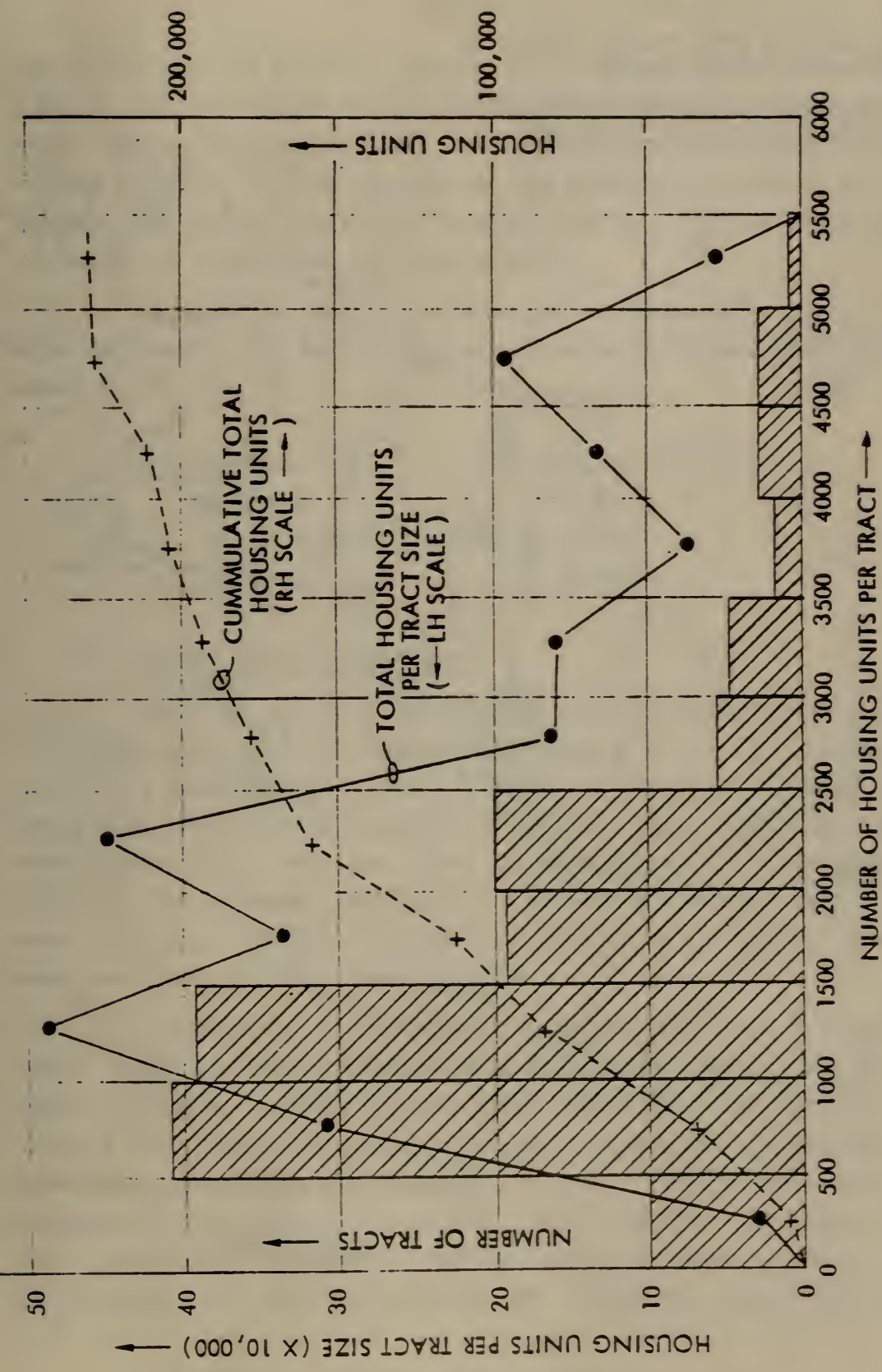

FIG. 3 DISTRIBUTION OF HOUSING UNITS PER CENSUS TRACT

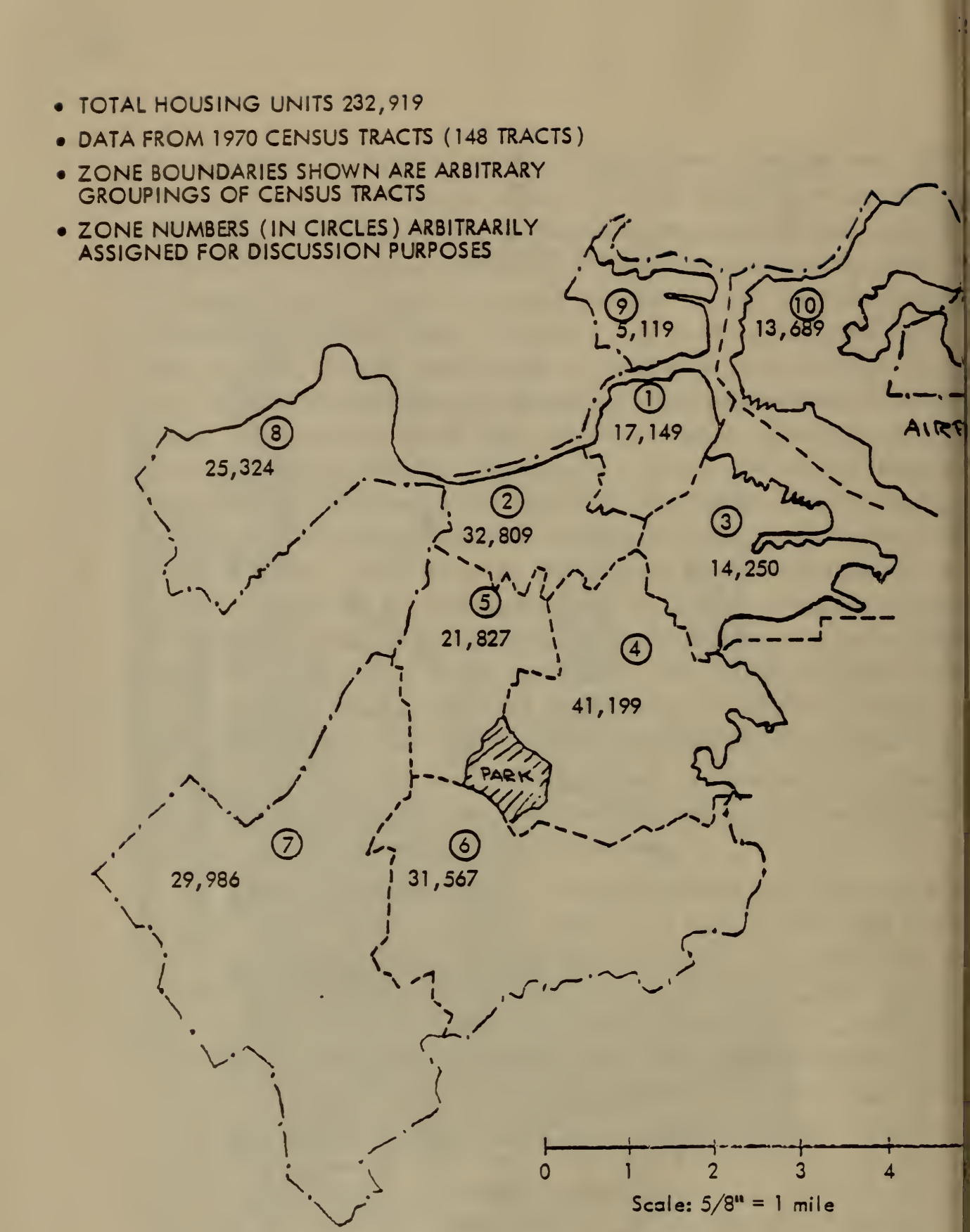

FIG. 4 HOUSING UNITS IN BOSTON BY ZONE

5 by 4-1/2 miles in size and contains 61,553 housing units (zones numbered 6 and 7), but has only about 40% of the housing density of the central area above. Third, Brighton (zone 8) is a compact, isolated area of intermediate housing density. Finally, East Boston and Charlestown (zones 9 and 10) together account for only 18,808 housing units in a rectangle five miles by two miles, of which about one-half is water.

Although the land areas have not been computed exactly, the housing units per square mile for the four general areas discussed above are approximately as follows:

Central area	-	7,400 units/mi.^{2}
Brighton	-	4,800 " "
East Boston/Charlestown	-	3,800 " "
SW area	-	2,750 " "

2. How to Divide Up the City?

There are of course innumerable ways to divide up the city for CATV layout purposes. For example, the 10 zones of Fig. 4 could form one basis for a multi-headend system, with each of the 10 zones having its own headend (or sub-headend). Because of the small dimensions of most of the zones, however, much the same effect can be obtained from a smaller number of hubs or sub-headends, each serving a number of separate trunks. A description of a possible four-headend layout based on the four general areas described above is presented below.

A headend located near Boston City Hospital would be about at the center of the 2-1/2-mile radius central area we have defined and could serve zones 1-5 with one or more separate trunks each. The Southwest area of Fig. 4 (zones 6 and 7) could be covered by one sub-headend located in Forest Hills, a bit south of the junction of zones 5, 6, and 7. The service radius of this sub-headend would be about four miles, and it might use 2-3 trunks for each zone. Sub-headends in Brighton and East Boston are fairly obvious because of the isolation of these areas from the rest of Boston. This still leaves

Charlestown, which on a proximity and combined-total housing-unit basis might logically be served from an East Boston sub-headend. However, since the open harbor separates these two communities, and there are no bridges crossing between them, there is no way to directly interconnect them except by microwave relay. On the other hand, a cable connection across the Charlestown Bridge between Charlestown and downtown Boston would be feasible and Charlestown should therefore probably be combined with downtown Boston (zone 1) and served from the central headend (greatest airline distance four miles). It is assumed that an East Boston sub-headend could be connected via a cable through one of the three under-harbor tunnels.

A very schematic layout of the possible system configuration just described with a central headend and the three sub-headends is shown in Fig. 5. The 20 service trunks shown would average 11,700 housing units each, and would range from two to four miles in length. It is also of interest to note that the three headend interconnections required (the heavy lines) are almost exactly equal in length--four miles (airline). Allowing for somewhat greater installed cable length, these would require 7-8 amplifiers each (2,800-foot spacing) if one-inch "super-trunk" cable were used. If it is assumed that the greatest distribution amplifier cascade (trunk amplifiers plus line extenders) between any subscriber and his service headend or sub-headend was also eight amplifiers, then the maximum total upstream/downstream amplifier cascade from a remote TV origination anywhere in the Boston city limits to a subscriber anywhere else in the Boston city limits would be 32 amplifiers which, as discussed earlier, is the presently accepted maximum cascade for acceptable distortion in a 30-channel-per-cable system. Examination of Fig. 5 makes it clear that this limit would be reached only for an origination at the extreme of a sub-headend trunk, and that most of the possible cascade combinations for remote origination would be considerably less than 32.

The assumption of a maximum 8-amplifier distribution amplifier cascade for the layout of Fig. 5 is probably incorrect, however, since some of the distribution trunks are at least four miles in length (7-8 trunk

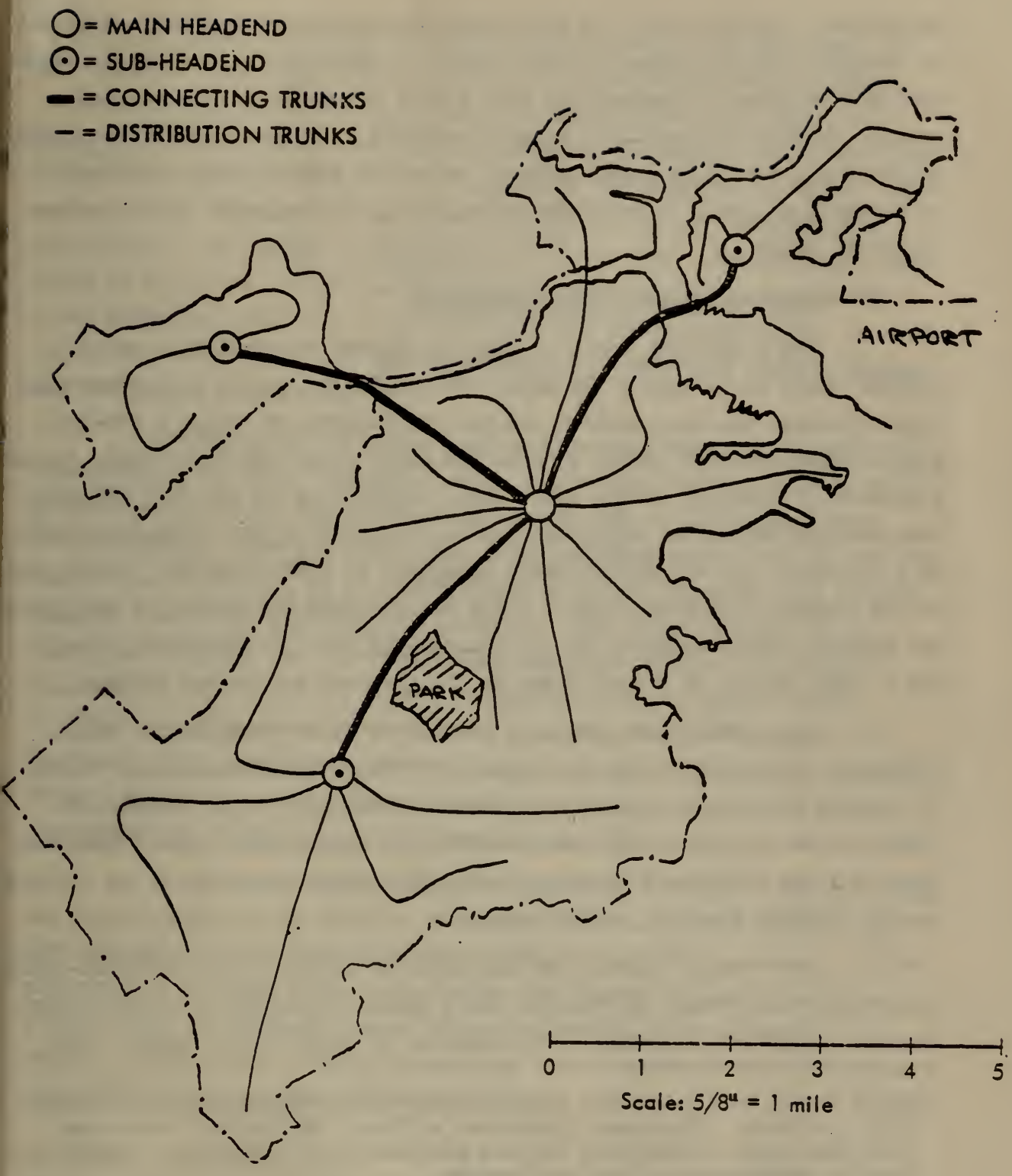

FIG. 5 POSSIBLE MULTI-HEADEND LAYOUT CORRESPONDING TO FIG. 4

amplifiers) and there will be additional line-extender amplifiers required in the sub-trunk and feeder cables needed to reach all subscriber locations. Thus distribution throughout the city from a remote TV origination at an extreme point (say Readville) appears marginal at best in the layout shown. Originations closer to a sub-headend, or in the central area, would still be feasible however. Ways of improving the interconnection situation are discussed below.

3. Improved Headend Interconnections

One thing that could be done to improve the amplifier cascade problem would be to reduce the number of amplifiers in the interconnecting trunks between the main headend and the sub-headends by using a sub-band signal transportation system such as the Ameco METRO-COM (previously called FLEXICADE).* Because of the lower cable attenuation in the 6-48 MHz sub-band used in METRO-COM, amplifier spacing is one mile for 0.500-inch cable, or 1-1/2 miles for 0.750-inch cable (compared to 2,800 feet for 1-inch cable in the regular 50-300 MHz band). This would reduce the number of amplifiers per headend interconnection to 3-4 (instead of the 7-8 previously cited), for a total saving of 8 amplifiers in the greatest end-to-end cascade.

Since METRO-COM carries a maximum of seven channels per cable, 6-8 cables in parallel might be required for these interconnection trunks to provide the necessary number of two-way channels (in the Connecticut installation referred to in the footnote, the main 25-mile interconnection trunk has ten 0.412-inch cables--six for TV channels, one for 28 FM signals, one for reverse signals, and two spares).

There would however be only about 12 miles of such multiple-cable interconnecting trunk, and capital costs appear comparable to conventional dual-one-inch, two-way trunk. For example, if eight 0.500" cables were

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*"Cable in the Valley--A Mass Transit System", TV Communications, February 1973, pp.84-86. This paper describes a 25-mile METRO-COM "supertrunk" providing eight communities between Naugatuck and Huntington, Connecticut with 24 channels--all from one headend.

"FLEXICADE--An Evolutionary Cable System", J.W. Blanchard, NCTA 1972 National Convention Record, pp. 411-438.

used, there would be a total of 507,000 feet of cable at $162/1,000', or $82,000 for cable. Allowing $5,000 each for nine eight-cable amplifiers (exact pricing has not been ascertained), total capital cost would be $137,000. On the other hand, the 1-inch cable costs about $678/1,000', and 127,000 feet would be required for dual-cable interconnecting trunks, for a cable cost of $86,000. To this must be added $36,000 (24 amplifiers at $1,500 each) for a total of $122,000--almost the same. Installation costs would of course be greater for the greater number of cables, but even if total METRO-COM trunk cost were twice that for conventional trunk, it would be a small price to pay for the capability of transmitting signals between any two points in the city.

The other way to reduce inter-headend amplifiers is to eliminate them entirely by use of microwave relay, a practice becoming fairly common in CATV systems since the introduction of low-cost amplitude-modulated relay equipment about two years ago. This equipment costs about $5,000 per channel per direction, so an interconnection with 30 forward and 6 reverse channels would cost approximately $180,000. This would not need to be duplicated entirely for all three interconnections because all forward transmission could make use of one transmitter with multiple antennas directed toward the three sub-headends. The Mitre Corporation study for Washington, D.C., estimated $280,000 for a microwave relay system to interconnect six sub-headends.* Mitre also estimated that trunk cable interconnections would cost more than twice as much ($667,000).

It seems clear that special attention will have to be paid to headend interconnections in order to assure the capability of TV transmission from any point to any other point at acceptable distortion levels. Whether microwave or sub-band trunk cable is the best choice will depend on the actual number of headends chosen for a city system, their locations, the number of forward and reverse channels per interconnection, and definitive cost studies based on these parameters.

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*"Urban Cable Systems", Mitre Report M72-57, May, 1972, p. IV-7.

GLOSSARY OF TERMS AND ABBREVIATIONS

ACCESS:	The ability to use a cable system, either as a transmitter of programm or services over cable channels or a viewer of what is transmitted.
ANTENNA:	An instrument which receives over-t air signals, usually centrally loca on top of a tall building or hill.
AMPLIFIER:	An electrical device which strength sound or picture signals which othe wise deteriorate as they travel thr cable.
AUDIO:	Having to do with sound; the sound tion of a television signal.
BROADCAST:	Of or concerning over-the-air trans (as opposed to over-the-cable, tran of cablecast) on standard assigned quencies.
CATV:	Community Antenna Television, any s which, in whole or part, receives o the-air signals, amplifiers or othe modifies them and distributes the s over wire or cable to paying subscr
CABLECASTING:	Programming distributed on a cable which is originated by the cable op or by other entity, exclusive of br cast signals, and transmitted on a system.
CABLE DISTRICT:	A geographic part of a city designa for the purpose of establishing a c system.
CABLE SYSTEM:	The facility used in transmitting e signals over cable, including the a head-end, studios, cables and all o equipment.
CHANNEL:	A range of frequencies designated f transmission of communications sign
CHANNEL CAPACITY:	The number of video signals that ca simultaneously transmitted - broadc television can accommodate 12 VHF c

COAXIAL CABLE: A transmission line comprised of two concentric conductors which are insulated from one another by a layer of polyethylene foam and all of which is sheathed in a seamless aluminum tube.

COMMERCIAL CHANNEL: A communications channel used for the transmission of commercially sponsored programming or leased out for a fee.

COMMON CARRIER: In cable television, usually refers to channel space available to users on a non-discriminatory, first come, first serve basis.

CONVERTER: An instrument used to change the frequency or channel of a signal.

DATA CHANNELS: Communications channels used for the transmission of digital or analog data (usually of narrower Megahertz width than an audio visual channel).

DROP WIRE: Small cable that branch from the feeder lines directly to subscribers television set or convertor.

FASCIMILE: Any of a number of methods used for sending hard copy pictures by wire or radio circuits.

FCC (FEDERAL COMMUNICATIONS COMMISSION: United States government agency charged with regulation of interstate radio and television radiations in the air including radio, tv and wire.

FEEDER LINES: Coaxial cables running between trunk lines and individual house drops.

FRANCHISE: License granted by local government to construct and operate a cable system and to use certain public facilities and rights of way.

FREQUENCY: Number of cycles per second

HARD COPY: A printed copy on paper in readable form.

HARDWARE: Any and all physical equipment of a cable system.

TRANSMITTER:	Device that sends signals.
TRUNK LINE:	Coaxial cables running from head-end and comprising main arteries of cable system.
VIDEO:	Picture portion of television signal.

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